



# RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

Vol 51

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No 1

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# RADIOLOGY

A MONTHLY PUBLICATION DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

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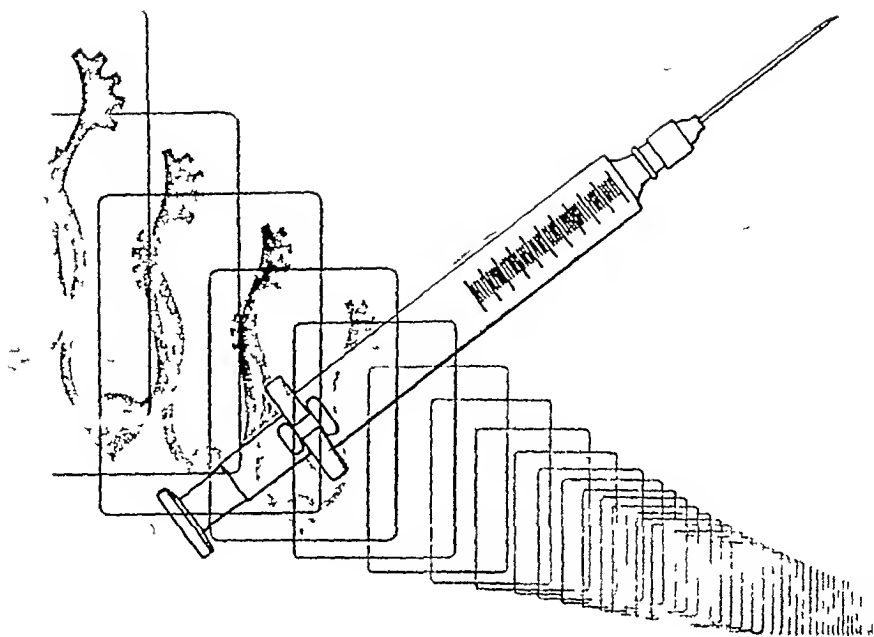
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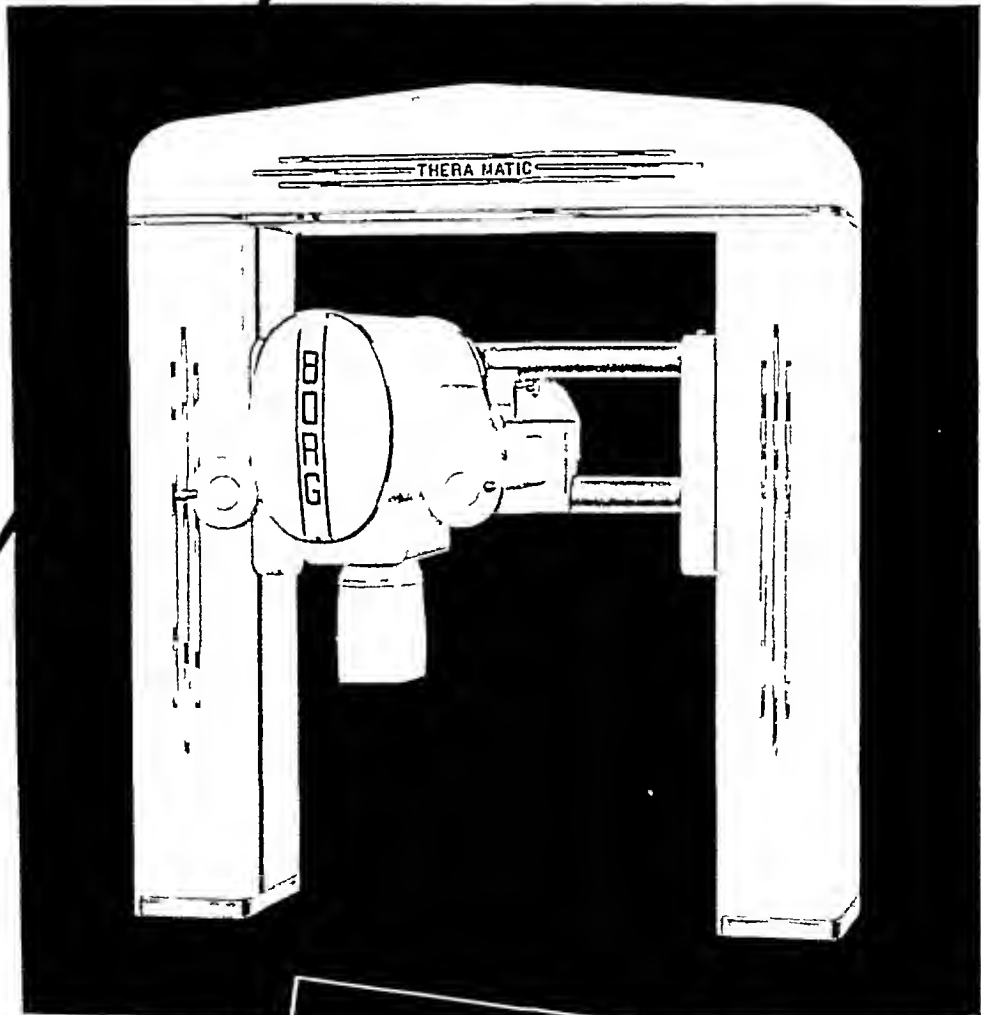


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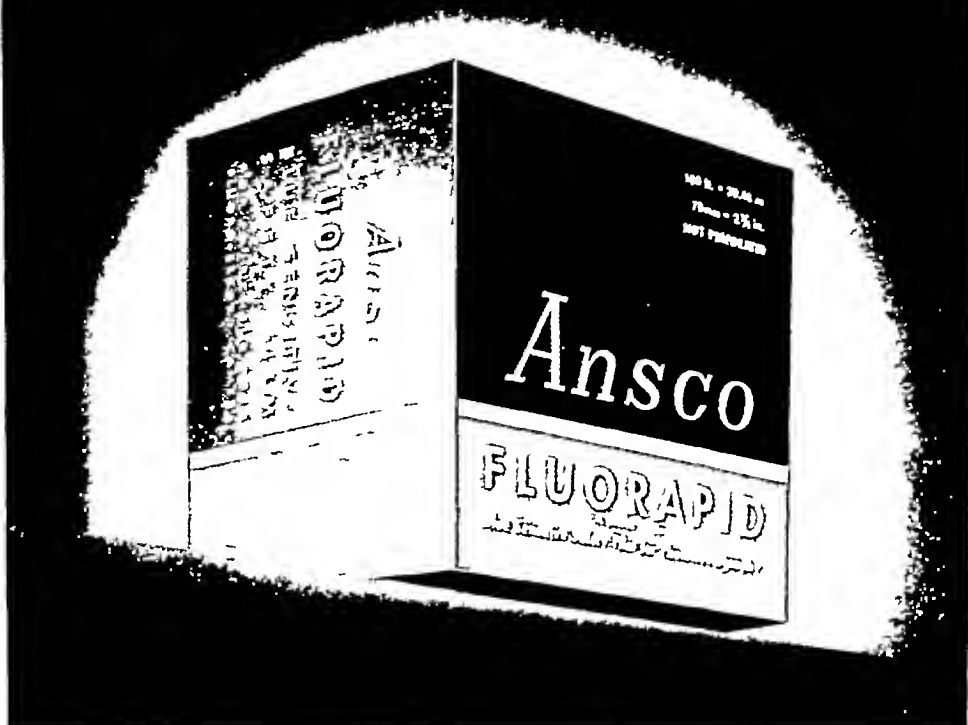


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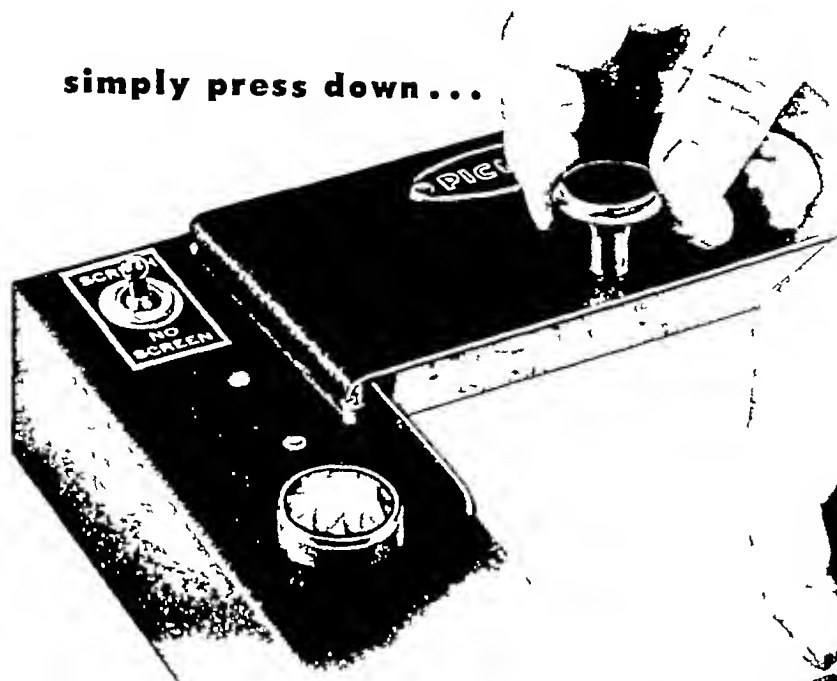
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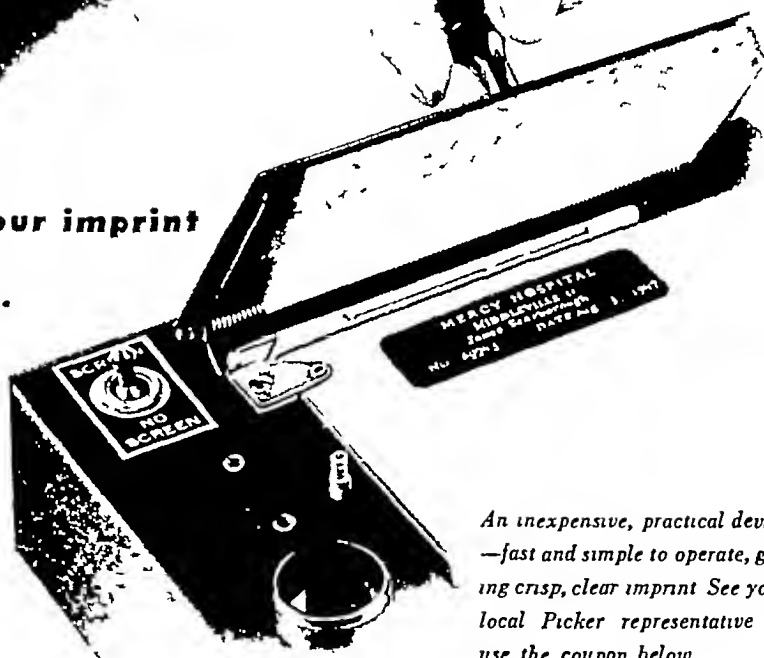
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Vol 51

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## The Roentgen Diagnosis of Rickets Associated with Other Skeletal Diseases of Infants and Children<sup>1</sup>

RALPH S BROMER, M D, and ROLFE M HARVEY, M D

Bryn Mawr, Penna

**R**ACHITIC INVOLVEMENT of the skeleton in infants and children occurs occasionally in association with other disease processes. Examples of this are the combination of rickets and congenital syphilis, rickets and infantile scurvy, rickets and lead poisoning, and rickets and erythroblastic anemia. A case of osteogenesis imperfecta seen in the Children's Hospital has been previously reported (Bromer, 1), in which rickets developed at the age of three months and signs of infantile scurvy at the age of twenty-one months. The roentgen diagnosis of rickets and associated conditions is often difficult. Lack of autopsy material prevents, to a great extent, confirmatory study of the underlying histologic picture of the associated processes.

### RICKETS AND INFANTILE SCURVY

Infantile scurvy and rickets are now much less prevalent than in the decade of 1920-30 and earlier years. Their etiology is definitely established and, when they do occur, it is because of ignorance or lack of adequate preventive or curative treatment. Borderline cases, however, are still seen, and occasionally a fully developed case is encountered.

McIntosh (7) has stated that it was common in the past to make a diagnosis of co-

incidental clinical rickets in a large proportion of patients showing unmistakable scurvy. With the development of roentgenographic and chemical criteria for the detection of rickets, the tendency to make that diagnosis in addition to scurvy, largely because of the rosary, has declined. McIntosh further states that histologic evidence shows that the two conditions do at times occur in the same patient. In his series of 186 cases of scurvy from the Babies Hospital there were 15 patients (8 per cent) who had craniotabes, one of them also showing signs of tetany. Evans (4) made the diagnosis of associated rickets in 36 of the 93 (38.7 per cent) cases of scurvy constituting his series. Folks, Jackson, and Park (5), in a series of 57 autopsies on children between three and nine months of age, in whom scurvy was proved by histologic examination of the bones, found rickets, demonstrated in similar fashion, in 26 (46 per cent). They believed that in all probability rickets was present in a greater percentage, because, when the scurvy was extreme they could not always be sure that it did not mask the rickets. They found that such criteria as a history of vitamin deficiency, the season of the year when the patient came under observation, results of clinical and roentgen examination -

<sup>1</sup> From the Department of Roentgenology, Children's Hospital of Philadelphia, Penna. Presented at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30-Dec. 1, 1947.

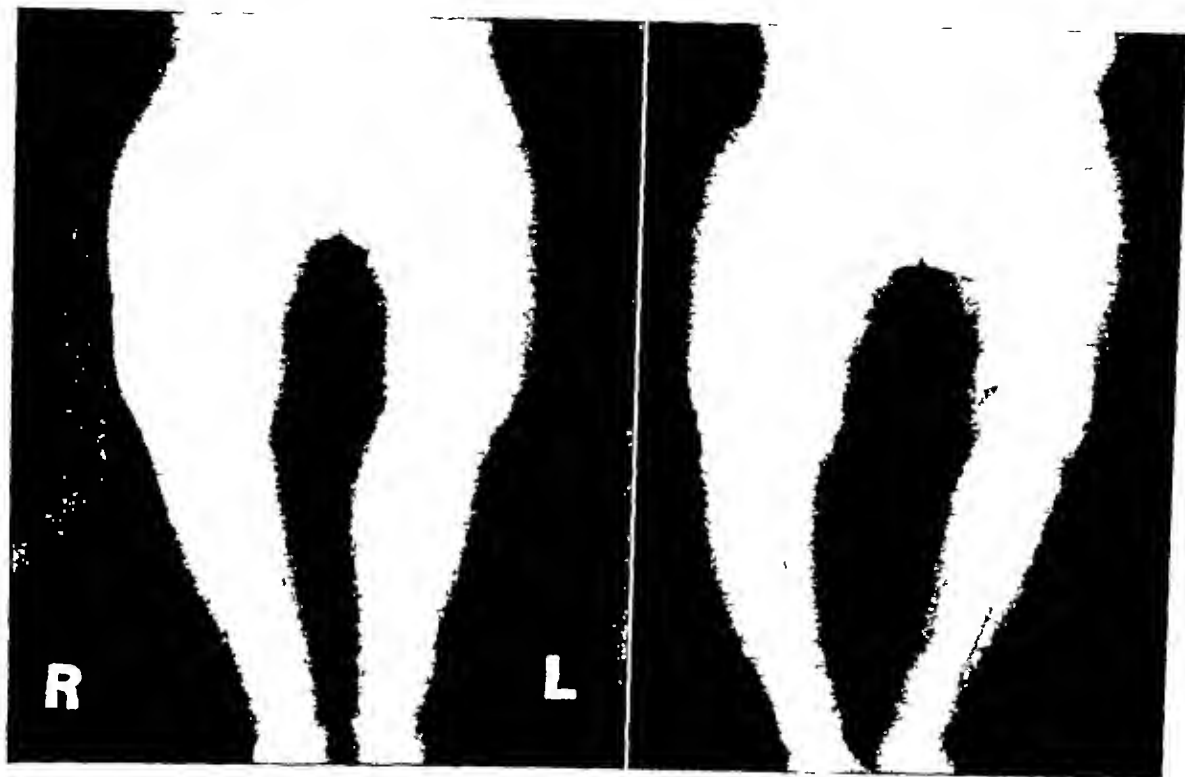


Fig 1 An eight-month-old, colored female, poorly developed, fed on milk alone with occasional orange juice. Blood Wassermann and Kahn four plus. Clinical signs of rickets and scurvy. The zones of temporary calcification are not dense, as is usual in scurvy. Laminated periosteal changes are present which could be due either to healing rickets or congenital syphilis. The rarefaction of the diaphyses resembles rickets rather than scurvy. Frank subperiosteal hemorrhages of scurvy developed after an interval of a month.

measurements of calcium, inorganic phosphorus and phosphatase of the blood serum, were not satisfactory. The roentgen examination did not reveal rickets unless the disease was well developed. Wimberger (10), in his study of rickets and scurvy in Vienna following the first World War, stated that when scurvy develops in the healing period of severe or moderately severe rickets the roentgen recognition of both is possible.

The problem of recognition of rickets and scurvy occurring simultaneously is a difficult one for the roentgenologist. When can he be reasonably sure that he can make a diagnosis of the combined diseases? Some signs are common to both, as rarefaction and thinning of the cortex, spreading or cupping of the diaphyseal ends, lateral spurs, formation of the rosary at the rib ends, and the appearance of the zone of preparatory calcification.

From our experience during the past

twenty-five years we believe that the diagnosis of the combined diseases can be made with a high percentage of accuracy in certain cases. Our observations are in accord with those of Follis, Jackson, and Park. In most of the combined cases, the signs of scurvy have tended to obscure those of rickets, unless the latter was well developed and severe.

Of the signs of identification of the combined diseases, rarefaction of the cortex is of significance. So-called ground-glass atrophy is not pathognomonic of scurvy, nor is the rarefaction noted in well developed rickets—often termed moth-eaten or grainy—pathognomonic of that disease. However, in spite of the present tendency to discount the usefulness of the ground-glass appearance of the cortex and even to doubt its existence, we have found it an occasional sign both in well developed scurvy and in the earlier pre-hemorrhagic stages. The moth-eaten rachitic rarefac-

tion is more useful as a diagnostic sign. In several cases the latter predominated and completely obscured any ground-glass appearance. This is in accord with the previously reported finding of Evans (Fig 1).

A second observation which is useful is the appearance of the zone of preparatory calcification. In scurvy, it is denser and at times broader than normal. In rickets, in the stage of onset and further development before healing begins, it is frayed out, hazy, and poorly defined. Again due to the fact that the rickets is severe, the latter picture has predominated in some cases of the combined diseases. Follis, Jackson, and Park, in their study of histologic sections, found that a deficiency of vitamin D results in failure of lime salts to be deposited in growing bone and cartilage, and that, if the deficiency is prolonged and severe, the lattice of the calcified matrix framework which is so characteristic of uncomplicated scurvy does not form at all or else forms incompletely. They conclude that from the histologic point of view, vitamin D deficiency certainly inhibits vitamin C deficiency from expressing itself and probably, on occasion, may mask vitamin C deficiency altogether. In the roentgen film, rickets may prevent all the characteristic signs of scurvy, namely, the rarefaction zone in the metaphysis, the cleft at the end of the diaphysis, the dense zone of preparatory calcification and the shadows cast by the periosteum elevated as the result of hemorrhage. Follis and his associates believe that clinically, also, rickets interferes seriously with the recognition of scurvy and that quite probably it prevents, to some extent at least, the development of the pain and tenderness that are characteristic of the latter condition. Several of our cases illustrate the predominance of the rachitic signs in the endochondral metaphyseal area as indicated by the histological findings of Follis, Jackson, and Park (Fig 2).

In cases of the combined diseases, the osteoid zone of rickets can be definitely diagnosed by a marked increase in the width of the clear space between the epiphyseal center and the end of the diaphy-

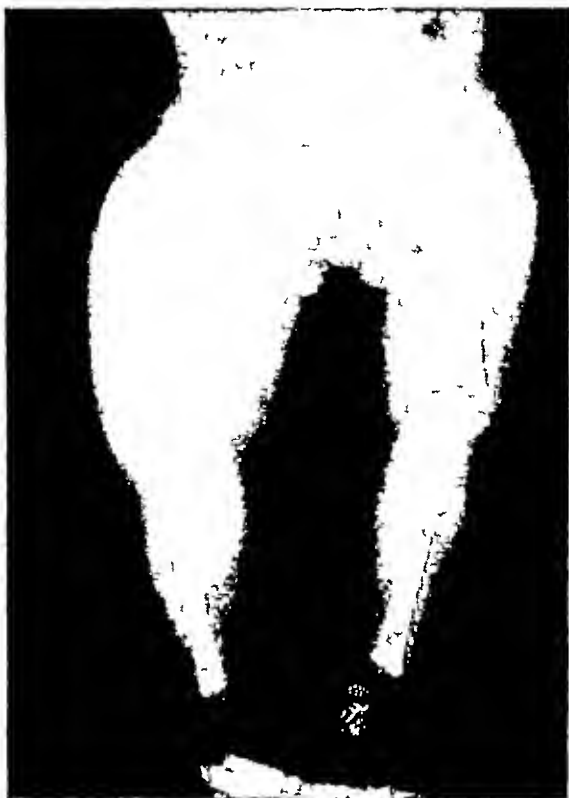


Fig 2 White male child seven months of age, with a history of insufficient cod-liver oil and orange juice. No increased density of the zones of temporary calcification. Increased width of space between the metaphysis and epiphyseal center, in the upper extremity of each tibia indicative of rickets. Lateral spurs and intact ring shadows about the epiphyseal centers caused by scurvy, also large subperiosteal hemorrhage, right femur.

sis. This sign is variable, however, and should not be considered definite unless the space is widened so as to remove all doubt that an actual increase exists. In these cases the zone of preparatory calcification is usually frayed out. Thus, too, coincides with the opinion expressed by Follis, Jackson, and Park, that, theoretically at least, deficiency of vitamin C should interfere with the development of signs of rickets. Osteoblastic activity is inhibited, and the development of the osteoid coverings of the bones, which is one of the cardinal signs of rickets, is diminished or stopped. However, their studies showed that osteoid formation can be extremely well developed even in the presence of scurvy (Fig 3).

In all of the combined cases, the ring shadow about the epiphyseal center has remained intact, indicative of scurvy, al-



Fig 3 Female colored, age fourteen months, with a history of insufficient cod-liver oil and orange juice. Widened spaces between metaphyses and epiphyseal centers, indicating rickets, small subperiosteal hemorrhages of scurvy.

though at the end of the diaphysis the zone of preparatory calcification has a frayed-out appearance. This, in all our experience, has proved a constant finding. The ring shadow of the center of ossification is analogous to the zone of preparatory calcification in the shaft. Why this should be preserved and the latter become moth-eaten has not to our knowledge been explained in the literature, and our autopsy material is not sufficient to offer a satisfactory histologic explanation (Fig 4).

Spreading of the diaphyseal ends cannot be considered indicative of either one or the other disease, as it may occur in both. The distinction between the lateral spur of scurvy and the cupping of the diaphyseal ends in rickets can be made only when vertical projections through the zone of preparatory calcification are secured, otherwise the appearance of rachitic cupping, such as is seen in uncomplicated rickets, will be simulated. This vertical projection is also essential for estimation of the width

of an osteoid zone of rickets. In almost all cases when lateral spurs were shown they extended outward at a right angle to the end of the shaft. Semicircular deposition of calcium along the borders of the resting cartilage adjacent to the zone of preparatory calcification was much less frequently shown.

The periosteal changes in scurvy have been fully discussed by Evans (4). Periosteal shadows as described by him are of two types. The first is a narrow triangular shadow having its base at the metaphysis and extending for some distance along the shaft. The second, the periosteal shadow produced by more severe hemorrhage, is larger, is usually club-shaped, and extends along the greater length of the shaft. It is quite constantly associated with displacement of a large portion of the metaphysis and the epiphysis as well. As healing proceeds, the dense shadow of the hemorrhage decreases in size and ultimately slight roughening and sometimes an uneven

thickening of the periosteum may remain, persisting for variable lengths of time, up to a year or more. The periosteal shadows of rickets are hazy, and the periosteum appears slightly thickened, due to deposition of rachitic osteoid tissue. With continued healing, these shadows become denser and show a laminated appearance. The involvement is usually in approximately the middle third of the shaft but may, in severe cases, extend for its entire length. This laminated appearance is prominently shown in Figure 1. In this case, the moth-eaten appearance of the cortex persisted even after the periosteum had assumed a laminated appearance. Periosteal triangular shadows of comparatively slight width indicative of scorbutic hemorrhage merged with the rachitic periosteal elevation.

The x-ray demonstration of the rosary is difficult, lateral views having been suggested as the best method. In general, if clear definition can be obtained, the scorbutic rosary will often be seen to spread out in somewhat more circular fashion from the rib end with a tendency to a rather homogeneous, smooth appearance of the enclosed area, while the rachitic rosary will show a more frayed-out appearance of the rib ends similar to the appearance of the diaphyseal ends in uncomplicated rickets. This observation is not constant, however, and can only rarely be demonstrated. We do not have sufficient evidence to confirm our impression that the scorbutic rosary usually entirely obscures the rachitic change.

#### RICKETS AND CONGENITAL SYPHILIS

Our experience with the simultaneous occurrence of rickets and congenital syphilis has been extremely limited. The cases which we have seen have been confined to those occurring in early infancy. The diagnosis of rickets is dependent in these cases upon the recognition of the early signs of the disease, such as slight fraying out of the zones of preparatory calcification, early and slight spreading of the diaphyseal ends, slight periosteal thickening along the borders of the bones, es-



Fig 4 The flaring of the metaphyseal ends, the frayed-out zones of temporary calcification, the bowing and rarefaction of the diaphyses indicate rickets. The small subperiosteal hemorrhages at the distal ends of the diaphyses of the femurs and the intact ring shadows about the epiphyseal centers indicate scurvy.

pecially in the case of the radius and ulna where the interosseous muscles are inserted, and slight decalcification of the shafts. In no case could we determine the presence of the characteristic changes of osteochondritis luetica in the metaphyseal and epiphyseal areas of the long bones. The

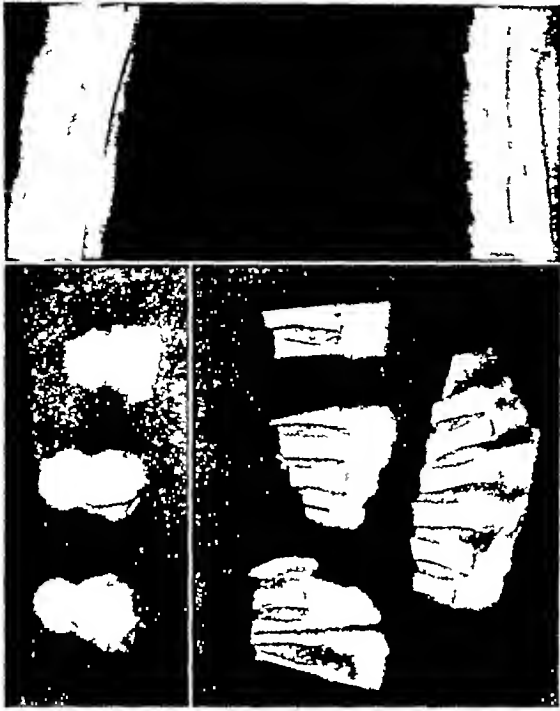


Fig 5 Male, colored, age two months. Positive blood Wassermann reaction. Clinical manifestations of congenital syphilis. Periosteal changes in the shafts of the bones of the forearms suggest congenital syphilis. Microscopic examination of autopsy specimens of ends of the ribs showed rickets.

periosteal involvement in the two conditions is so similar that differentiation in the roentgenogram is impossible. Park and Eliot (8) have stated that congenital syphilis may be a factor in the production of rickets. Just as an infection makes diabetes or scurvy manifest or converts mild forms into severe, so infection brings out, prolongs, or intensifies rickets. The infections which seem most commonly to exert such influences are the prolonged, relatively mild inflammations of the respiratory tract. During infections of long duration, treatment (of the rickets) may fail. It is possible that rickets developing in a case of congenital syphilis may thus be severe enough to obscure completely the signs of osteochondritis luetica (Figs 5 and 6).

In one case extreme periosteal cloaking such as is seen in congenital syphilis was present in the femurs and tibias together with marked cupping of the diaphyseal ends and dense and broadened zones of

preparatory calcification. In this case, however, the first examination was made after antiluetic treatment was begun. The periosteal involvement seemed to be of luetic origin. The marked cupping could have been due to rickets, but this was by no means pathognomonic. At autopsy, histologic examination of the rib ends showed definite rachitic changes. This is the one exception where the syphilis apparently masked the rickets. It is possible that the dense zone of preparatory calcification indicated a healed osteochondritis.

#### RICKETS AND LEAD POISONING

In 1938, Caffey (2) reported a case of lead poisoning associated with active rickets. The patient had chronic lead poisoning and active rickets of long standing, but in the roentgenograms lead zones at the diaphyseal ends of the long bones could not be demonstrated. A few months after the appearance of Caffey's paper, a girl, three years of age, was admitted to the Children's Hospital because of vomiting for ten days previous to admission. At the age of two weeks she was given viosterol, 2 drops t i d for seven weeks, when it was discontinued because of vomiting. Administration of viosterol was again begun at the age of fourteen months, 3 drops t i d was given for a period of four to five weeks and again was discontinued because of vomiting. At two and a half years of age viosterol was again given, 10 drops t i d for three months, and the patient took it without difficulty. It was given for two more months with frequent vomiting and was then discontinued. At 14 months of age, the child began to eat paint from wood. Orange juice was given at about one year of age for only two weeks, when tomato juice was substituted, but in inadequate dosage. Marked stippling of the red cells was shown, sugar and excess globulin were present in the urine. In the roentgenograms, a wide osteoid zone between the diaphyseal ends and the centers of ossification was shown, and the zones of preparatory calcification in the long bones indicated rickets in unmistakable fashion.



Fig 6 Male, colored age four and one-half months, malnutrition, lesions on buttocks suggestive of lues, craniotabes, beading of ribs. Mother's Kahn reaction was two plus. Patient's spinal fluid negative, likewise three blood Wassermann tests. Provocative Wassermann advised. Three injections of sulfarsphenamine were given but the patient was not brought back for further treatment. Slight tendency to spreading of the diaphyseal ends, slight fraying of the zones of temporary calcification and questionable osteoid zones at the metaphyseal extremities. No definite signs of lues. Changes apparently due to mild rickets.

Caffey drew attention to the fact that the lead line at the diaphyseal ends failed to develop in his case. In our case, the density at the end of the diaphysis was scarcely greater than is seen in normal bones. Caffey suggested that, since the essential pathologic feature of active rickets is the failure of calcification of the preparatory cartilage, it follows that, when active rickets and plumbism are present in combination, the lead lines cannot develop in the bones because calcification of the preparatory cartilage has ceased. There are two antagonistic mechanisms in simultaneous operation in the preparatory cartilage. One is the result of the lead poisoning, which causes an excessive calcification and "leadification" of the preparatory cartilage, while the second, or the rachitic component, prevents the deposition of calcium and lead at the same site. When the rachitic process is severe, one can infer that the preparatory cartilage will not absorb calcium or lead and the characteristic lead

line will be absent. Both calcification and leadification of the preparatory cartilage fail in cases of active rickets. This results in a layer of radiolucent, uncalcified cartilage and osteoid material in the terminal segment of the bone in place of the excess of radiopaque calcified and leadified cartilage which develops in plumbism without associated rickets and which is responsible for the lead line in roentgenograms (Fig 7).

Caffey's case was also interesting in that it apparently was not caused by a deficiency of vitamin D. He thought it could be explained on a dietary basis, the added intake of lead having produced a low-phosphate rickets. The intake of vitamin D was hardly sufficient in our case and thus the rickets could be accounted for on a deficiency basis, further aggravated by the intake of lead. With healing of the rickets, lead lines appeared similar to the finding in Caffey's patient. In healing, the roentgenograms showed the appearance of a new

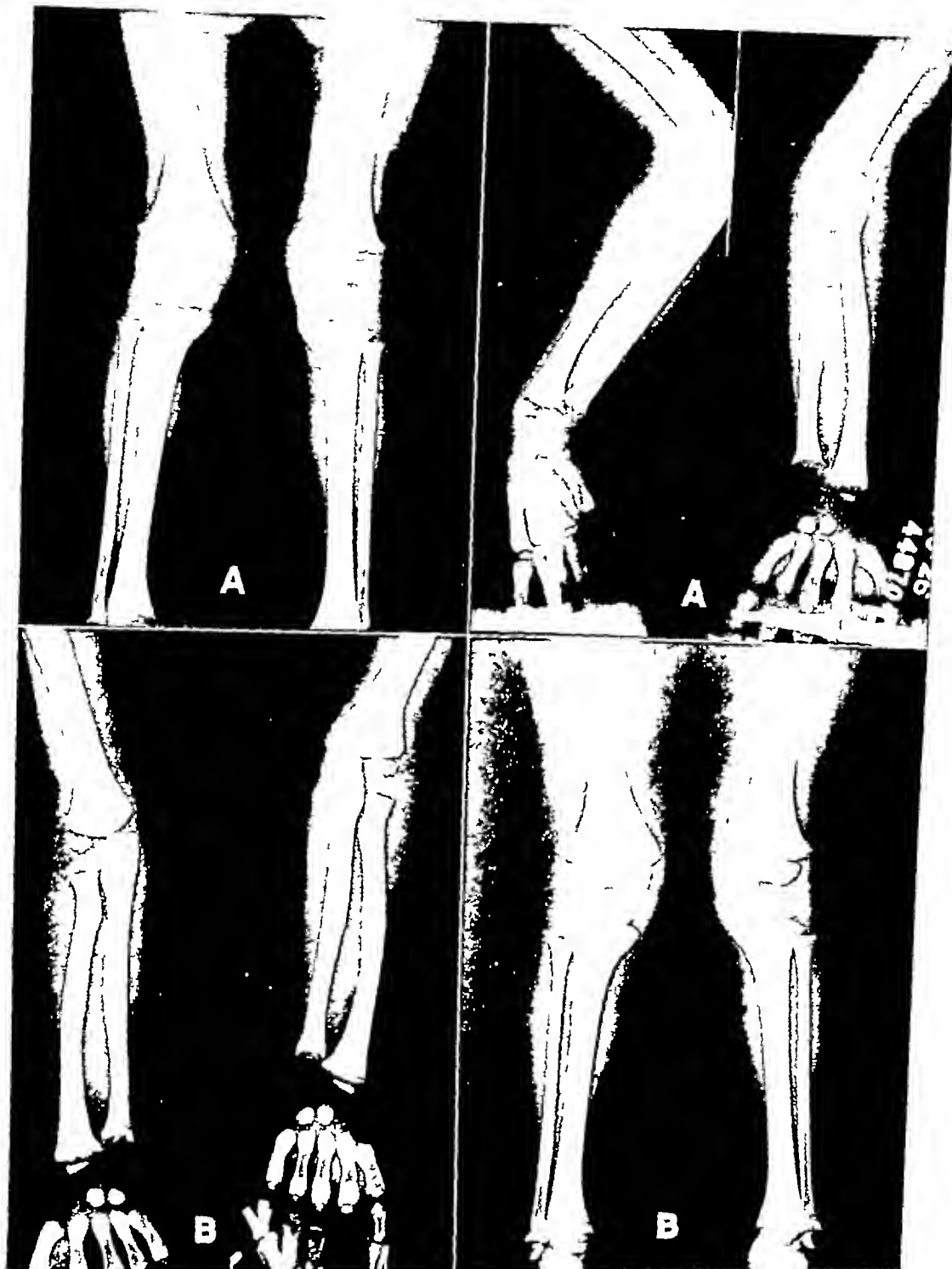


Fig 7 Combined rickets and lead poisoning A Fraying and some cupping of ends of the diaphyses with increased width between the ends of the diaphyses and the centers of ossification due to rickets The lead line at the diaphyseal end of each of the long bones is not marked B Same patient after seven weeks of antirachitic therapy Marked density at the ends of the diaphyses, with heavy lead line Disappearance of the clear spaces at the ends of the diaphyses due to the healed rickets

zone of preparatory calcification and progressive calcification of the intermediate or osteoid zone

#### RICKETS AND ERYTHROBLASTIC ANEMIA

Caffey (3), in 1937, reported a case of rickets occurring in a patient who had erythroblastic anemia. The rickets was demonstrated both chemically and roentgenologically. Rapid healing followed the administration of cod-liver oil. Caffey could offer no satisfactory explanation for the presence of rickets in the patient as late as the fourth year. He could find no other reported case in the literature. We have found no case of rickets associated with either erythroblastic anemia or sickle cell anemia.

#### RICKETS AND SCURVY OCCURRING IN A CASE OF OSTEOGENESIS IMPERFECTA

In a case of osteogenesis imperfecta (1), previously reported, in a Negro male infant of three months, roentgenograms on admission to the hospital showed evidence of pathological fractures, atrophy of the long bones, and a parchment-like skull. No definite blue tinge of the sclerae could be detected. In addition to the signs of osteogenesis imperfecta, examination of the bones of the forearm showed decalcification of the shafts of both radius and ulnae, slight flaring of the diaphyseal end of the right radius, and an osteoid zone distal to the frayed-out zone of preparatory calcification. The signs of rickets gradually disappeared with feeding of vitamin D. Six months later the patient was readmitted with clinical signs of scurvy. Subperiosteal hemorrhages, ring shadows about the epiphyseal centers, lateral spurs, and slightly increased density of the zones of preparatory calcification were easily detected in the roentgenograms. No orange juice had been given. The roentgen signs of scurvy gradually disappeared after vitamin C therapy was started. The child was admitted for a third time with a pathological fracture of the distal third of the left femur and on a fourth admission approximately two years after his first, he was

again admitted with a pathological fracture of the right humerus. At no time was there a definite history of trauma.

Since no pathological sections were obtained, the histologic appearance of the endochondral areas of bone growth could not be determined. Knaggs (6) has previously emphasized the lack of osteoblastic edging of the trabeculae in osteogenesis imperfecta. He also described three important variations from normal in the long bones: (a) In the formation of bone from the cartilaginous epiphysis, the first departure from the normal process of ossification is the formation of trabeculae by the calcification of the cartilage and their extension by metaplasia of the adjoining connective tissue of the marrow. (b) Intimately associated with this, and without doubt the cause of it, is the complete absence of rows of osteoblasts. (c) In the formation of bone under the periosteum is found the factor of the production by the periosteum of cartilage cells instead of osteoblasts. In the case reported the roentgen signs of both rickets and scurvy were typical and it seems justifiable to assume that the pathological changes of osteogenesis imperfecta interfered in no way with the development of either rickets or scurvy. The rickets was well healed when the scurvy developed.

#### SUMMARY

The roentgen diagnosis of rachitic involvement of the skeleton in association with infantile scurvy, with congenital syphilis, with lead poisoning, and with erythroblastic anemia is discussed. Mention is also made of a previously reported case of rickets occurring in a case of osteogenesis imperfecta.

When rickets is combined with infantile scurvy, the diagnosis of the associated diseases can be made with a high percentage of accuracy in certain cases by roentgen examination. In most of the combined cases the signs of scurvy tended to obscure those of rickets unless the latter was well developed and severe.

The combination of rickets and con-

genital syphilis was found only in early infancy. Differentiation of the periosteal involvement by the two conditions was impossible by roentgen examination. Rickets in the few cases observed seemed to be sufficiently severe to obscure the signs of osteochondritis luetica.

A case of rickets in association with lead poisoning is reported. Lead lines in the long bones were absent in the early stages but appeared coincidentally with the healing of the rickets, as in a case previously reported by Caffey.

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#### REFERENCES

1 BROWER, R. S. Rickets and Infantile Scurvy Occurring in a Case of Osteogenesis Imperfecta. *Am J Roentgenol* 55: 30-36, 1946.

2 CAFFEY, J. Lead Poisoning Associated with Active Rickets. Report of Case with Absence of Lead Lines in Skeleton. *Am J Dis Child* 55: 793-806, 1938.

3 CAFFEY, J. Skeletal Changes in the Chronic Hemolytic Anemias (Erythroblastic Anemia, Sickle Cell Anemia and Chronic Hemolytic Icterus). *Am J Roentgenol* 37: 293-324, 1937.

4 EVANS, W. A., JR. Periosteal Lesions in Scurvy. *Am J Roentgenol* 53: 147-156, 1945.

5 FOLLIS, R. H., JR., JACKSON, DEBORAH A. AND PARK, E. A. Problem of the Association of Rickets and Scurvy. *Am J Dis Child* 60: 745-747, 1940.

6 KNAGGS, R. L. Osteogenesis Imperfecta. *Brit J Surg* 11: 737-759, 1924.

7 MCINTOSH, R. Infantile Scurvy. In *Practice of Pediatrics* edited by Brennemann. Hagerstown, Md., W. F. Prior Company, Inc., 1945. Vol. 1, Chapter 35.

8 PARK, E. A. AND ELIOT, MARTHA M. Rickets. In the *Cyclopedia of Medicine*, Philadelphia. F. A. Davis Company, 1935. Vol. XI, pp. 1-59.

9 WIMBERGER, H. Zur Diagnose des Säuglings-scorbuts. *Ztschr f Kinderh* 36: 279-285, 1923.

10 WIMBERGER, H. A Study of Developing Flord and Healing Rickets as Demonstrated by X-ray Photography. *Studies of Rickets in Vienna 1919-1922*. Medical Research Council, Special Report Series No. 77. London, 1923. pp. 95-114.

#### SUMARIO

### El Diagnóstico Roentgenológico del Raquitismo Asociado a Otras Osteopatías Infantiles

Al discutir el diagnóstico roentgenológico de la invasión raquíica del esqueleto, asociada a escorbuto infantil, sífilis congénita, saturnismo o anemia eritroblástica, menciónase además una observación previamente comunicada de raquitismo en un caso de osteogénesis imperfecta.

Cuando el raquitismo se combina con escorbuto infantil puede hacerse el diagnóstico de las dos dolencias con un alto porcentaje de exactitud en ciertos casos por medio del examen roentgenológico. En la mayor parte de esos casos los signos del escorbuto suelen eclipsar los del raquitismo a menos que éste se halle bien desarrollado y sea grave.

La combinación de raquitismo y sífilis sólo se observó en la primera infancia. La diferenciación de la invasión perióstica producida por los dos estados resultó imposible con el examen radiológico. En los

pocos casos estudiados, el raquitismo pareció ser suficientemente intenso para eclipsar los signos de osteocondritis luética.

Describe un caso de raquitismo asociado a saturnismo. Los ribetes plúmbicos en los huesos largos faltaban en el período incipiente, pero coincidieron en su aparición con la cicatrización del raquitismo, según sucedió también en un caso comunicado por Caffey.

Cítase un caso descrito por Caffey de raquitismo coexistente con anemia eritroblástica, combinación esta que no ha sido observada por los AA.

En el caso, previamente comunicado, de raquitismo seguido de escorbuto, en un enfermo con osteogénesis imperfecta, fueron típicos los signos roentgenológicos tanto del raquitismo como del escorbuto. Cuando se presentó el escorbuto, el raquitismo estaba bien cicatrizado.

# Progressive Diaphyseal Dysplasia<sup>1</sup>

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**A**N UNUSUAL SYNDROME characterized by progressive skeletal changes, wasting, and anomalous neuromuscular signs as observed in four children over a seven-year period is being presented. A preliminary report on the first two of these patients was published by Riley and Shwachman in 1943. Additional information has since been gained on the course of this disease. Descriptions of similar disorders have not been found in the available literature.

**CASE 1** M. M. (Fig 1, A and B) was first seen in June 1941 at the age of four years and three months, because of a waddling gait, easy fatigability, and failure to gain weight. The family, birth, and neonatal histories were non-contributory. The child's development was normal, except for some difficulty in walking, up to two and one half years, at which time she had pertussis, followed by loss of appetite and persistent inability to gain weight normally. She was hospitalized at the age of four years and ten months for study.

The significant findings were underweight, a gait of straight-legged, wide-based, waddling type, hyperactive deep tendon reflexes and inconstant ankle clonus. Studies of the genito urinary, gastrointestinal, and circulatory systems revealed no abnormalities. Roentgen examination at this time showed changes in the diaphyses of the long bones as illustrated in Figures 2 (B), 3, and 4. The laboratory examinations, including blood Hinton test, tuberculin test 1-1000, complete blood count, spinal fluid study, and complete urine study, were within normal limits. The serum protein, calcium, phosphorus, alkaline phosphatase, and non-protein nitrogen were normal. A biopsy from the tibia at this time revealed increased density of cortical bone with evidence of active resorption (Fig 5).

The patient was followed at frequent intervals, and the striking feature at each visit was her failure to gain weight, attributed partly to extreme anorexia. During a short period of intensive dietary therapy in the hospital she gained well, but this gain was not sustained. Although she remained consistently far below normal weight, her height was in the low normal range. Table I shows the weight and

TABLE I CASE 1

Age (years)	Weight (pounds)	Percentile	Height (inches)	Percentile
3 <sup>11</sup> / <sub>12</sub>	27 5	Below 3	42 0	45
4 <sup>5</sup> / <sub>12</sub>	30 2	5	42 5	55
6 <sup>1</sup> / <sub>12</sub>	30 0	Below 3	46 0	50
9	34 7	Below 3	50 5	15
10 <sup>2</sup> / <sub>12</sub>	37 0	Below 3	51 0	7

the height at different ages, with the percentile distribution.

The child always tired easily and was never able to run. Dr. Bronson Crothers was instrumental in placing her under appropriate institutional care, where she is now happily adjusted and competitive activities are minimized. A biopsy from the ulna obtained in April 1947 is shown in Figure 6. Extreme and actively increasing disturbance of the bony architecture was noted, without evidence of inflammation. Roentgenograms at frequent intervals illustrate the progressive nature of the long bone involvement (Fig 3). The blood non-protein nitrogen, serum protein, glucose tolerance, cholesterol, calcium, phosphorus and alkaline phosphatase examinations have remained normal during the seven-year observation period.

**CASE 2** J. B. (Fig 1, C) was first hospitalized in June 1942, at the age of four years and eleven months, the chief complaint being a peculiar gait of eighteen months duration. The familial, natal, and developmental histories were non-contributory except that the child failed to walk until he was two years old. His gait was said not to have been abnormal until a limp was noted at the age of three and a half years, attributed at that time to a fall from a tricycle. However, he had never been able to run and always tired easily. Anorexia was noticed at about this time.

The child was well developed and well nourished. The outstanding physical finding was a gait of straight-legged, wide based foot slapping type. Inconstant ankle clonus and hyperactive tendon reflexes were present. He walked with extremely short steps. His muscles were easily fatigued but showed no localized weakness.

The following laboratory studies were negative: urinalysis, complete blood count, blood Hinton test, calcium, phosphorus, alkaline phosphatase, and serum protein determinations. The spinal fluid was

<sup>1</sup> From the Infants and the Children's Hospitals of Boston and the Harvard Medical School. Presented at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 20-23, 1947.

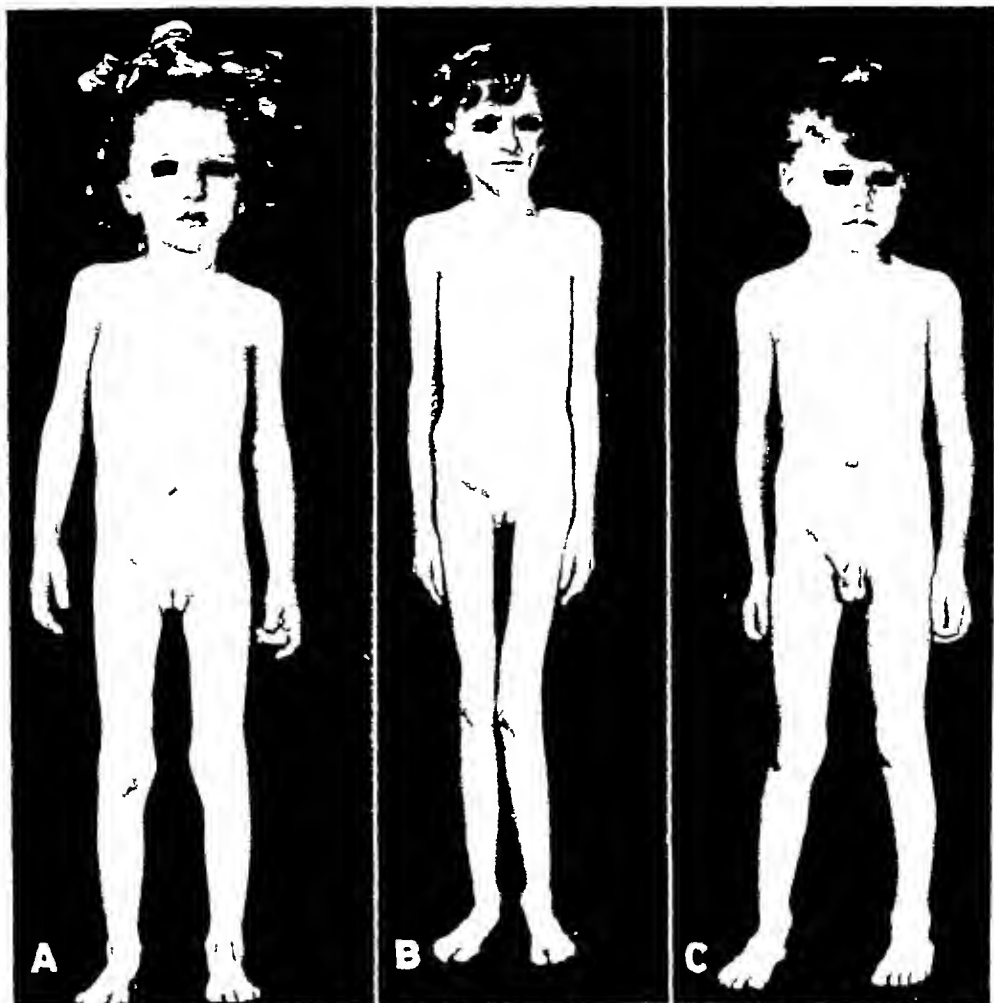


Fig 1 A M M aged four years and ten months B M M aged ten years and nine months  
C J B aged four years and two months (Figs A and C reproduced by courtesy of American Journal of Diseases of Children)

normal. Roentgenograms of the skeleton revealed changes in the long bones and skull as illustrated in Figures 2 (A), 7 and 8. A bone biopsy showed increased thickness of the cortical bone with evidence of active resorption.

Observation over a period of six years disclosed extraordinary progression of the changes in the long bones (Fig 7). The patient's weight and height at different ages are listed in Table II.

TABLE II CASE 2

Age (years)	Weight (pounds)	Percentile	Height (inches)	Percentile
4 $\frac{1}{2}$	39	50	43.5	80
4 $\frac{11}{12}$	38.5	30	45.7	65
5 $\frac{10}{12}$	55.2	10	52.2	45

The neuromuscular findings—hyperreflexia, peculiar gait and inability to run—remained un-

changed. Mental development was normal. Laboratory examinations remained normal.

CASE 3—J K was first noticed to have a waddling gait at six years of age. In spite of a good appetite, she failed to gain in weight and at the age of ten years she was admitted to a nearby hospital. No other complaints were elicited.

Physical examination at this time revealed a thin, co-operative, intelligent, underdeveloped girl. The chief finding was a waddling gait with a list to the right, as though one leg were shorter than the other. Nevertheless, leg measurements were equal. There was diffuse atrophy of both lower extremities with a diminished patellar reflex on the right. Findings on examination of the heart were normal with the exception of a short systolic precordial murmur.

\* Presented through the courtesy of Dr Gilbert Heublen.

Roentgenograms of the chest and electrocardiograms were normal. No unusual laboratory findings are recorded. Roentgenograms of the skeleton revealed bone changes as illustrated in Figures 2 (B) and 9. No biopsy was taken in this case.

Table III shows the weight and height of the patient at different ages. She lacked stamina. The menarche occurred at fourteen years and was fol-

lowed by dysmenorrhea and oligomenorrhea. The secondary sexual characteristics were markedly underdeveloped.

muscular pains in her legs of one year duration, and they were easily fatigued. She had been treated for flat feet, by arch supports, without relief. Although her diet had been adequate her weight had remained at approximately 29 pounds for the past year.

The family history was negative. One sibling, aged two, was normal. The patient's development up to thirteen months of age was considered normal and

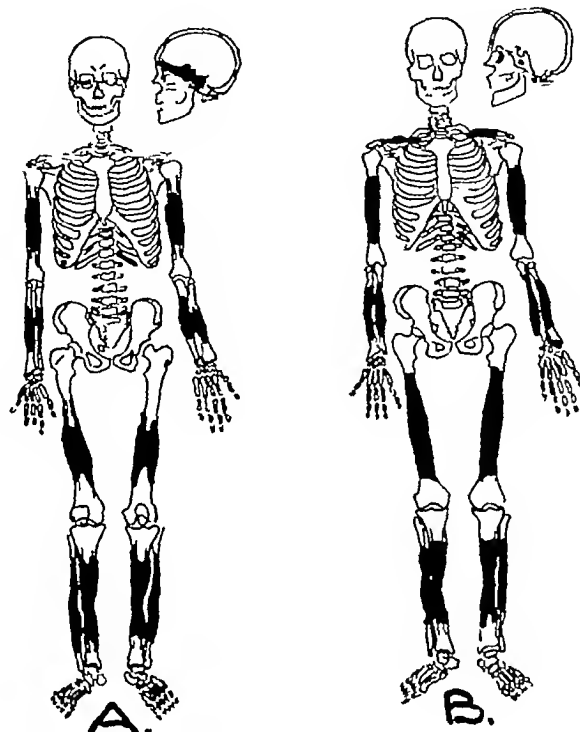


Fig 2 Distribution of the bone changes. The first and third patients (M M and J K) showed skeletal involvement as in B; the second and fourth patients (J B and N P) showed skeletal involvement as in A.

TABLE III CASE 3

Age (years)	Weight (pounds)	Percentile	Height (inches)	Percentile
9 <sup>5</sup> / <sub>1</sub>	44	3	48 <sup>1</sup> / <sub>4</sub>	20
9 <sup>3</sup> / <sub>1</sub>	46	Below 3	49	8
10 <sup>3</sup> / <sub>1</sub>	49	Below 3	50 <sup>3</sup> / <sub>4</sub>	8
11 <sup>1</sup> / <sub>1</sub>	55 <sup>1</sup> / <sub>4</sub>	Below 3	52 <sup>1</sup> / <sub>4</sub>	10
16 <sup>4</sup> / <sub>1</sub>	68		59	
17 <sup>4</sup> / <sub>12</sub>	75		60	

CASE 4<sup>3</sup> N P was first seen at the age of four years and four months, because of an abnormal gait noticed since she began to walk. She had vague

<sup>3</sup> Presented through the courtesy of Drs. William T. Green and Meier Karp.

only on retrospect and in comparison with the sibling did the mother consider the gait to have been abnormal. There had been no severe illnesses.

The patient was an alert, happy child weighing 27<sup>3</sup>/<sub>4</sub> pounds and measuring 36 inches in height (below the 3 percentile for both weight and height). The examination was negative except for the musculoskeletal system, which showed symmetrical generalized underdevelopment. The gait was a swaying one. There was no demonstrable weakness of any muscle group, although all muscles fatigued easily. The neurological examination showed no consistent alteration in the reflex pattern. The urine, complete blood count, blood Hinton test, spinal fluid studies, and blood non-protein nitrogen, sodium and chloride determinations were normal. The serum alkaline phosphatase was slightly elevated. The serum protein was 7.8 mg per cent, with albumin 3.7 gm and globulin 4.1 gm. Liver function tests were normal. The fasting vitamin A and caro-

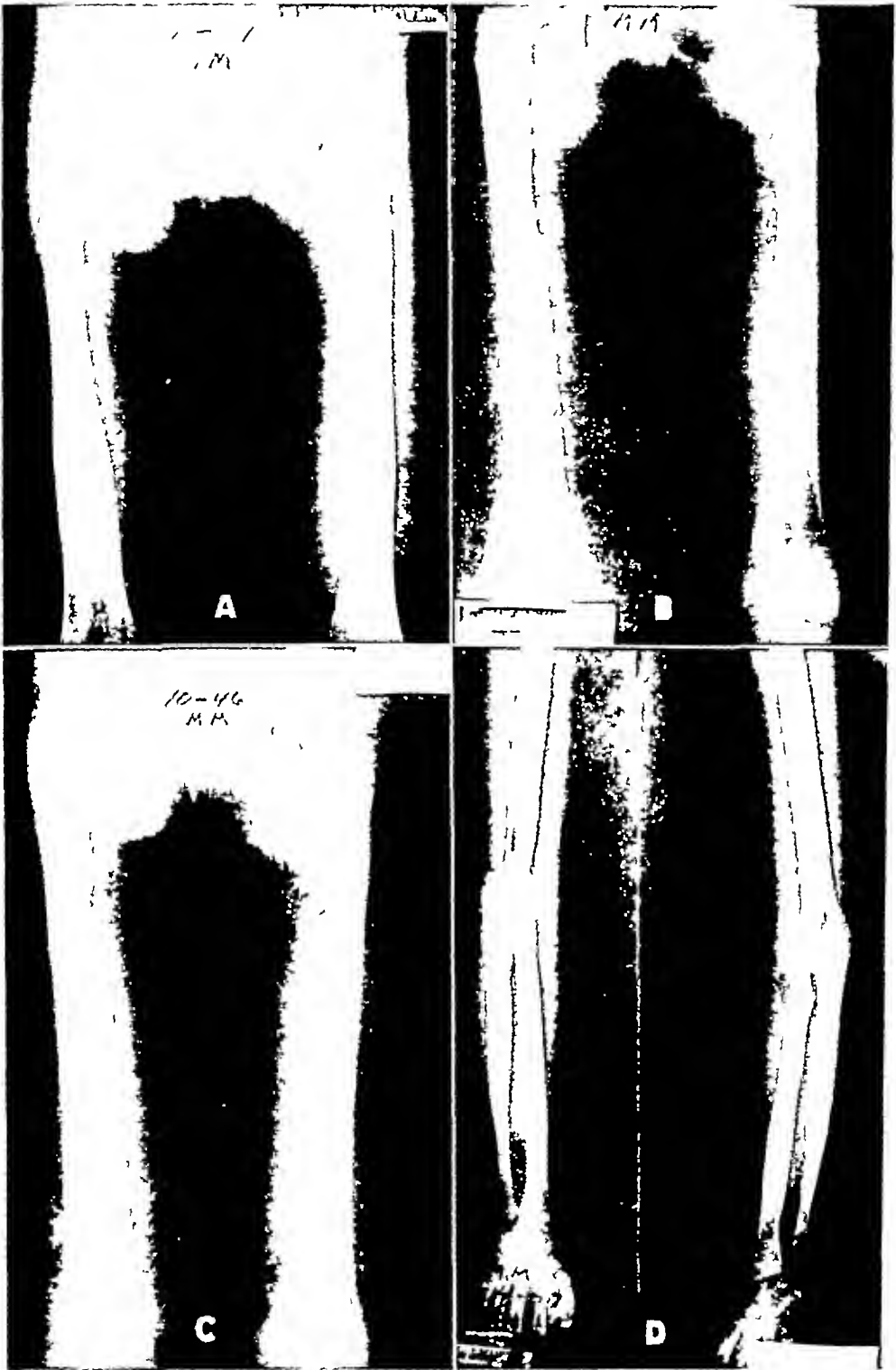


Fig. 3. Case 1. M. M. Progressive changes in the femora over a five year period, with similar involvement of the humeri and bones of the forearm. Note symmetry of involvement, thickening of the cortex with resulting fusiform enlargement of the diaphyses, maintenance of medullary space, and clear demarcation of the lesion. Involvement of skeleton shown in Fig. 2, B. A. January 1941. B. July 1943. C. October 1946. D. April 1947.

tenoid levels were normal. Roentgenograms revealed fusiform diaphyseal enlargement of all long bones (Fig 10). The skull showed slight involvement similar to that of Case 2. A biopsy of the tibia at an area of transition showed a diffuse periosteal thickening, with active remodelling of bone from a compact cortical structure to a looser cancellous network. A few perivascular lymphocytes and some thickening of vessel walls in the adjacent soft tissues were present.

#### RADIOLOGIC ASPECTS

The distribution of the skeletal changes in the syndrome under discussion is shown in Figure 2. Two cases revealed symmetrical involvement of the diaphyses of the bones of the extremities, excluding the bones of the hands, feet, pelvis, spine, and skull. Two cases showed similar distribution without clavicular involvement but with change in the base of the skull.

The roentgenological characteristics of the lesion are

- 1 Symmetrical skeletal distribution
- 2 Fusiform enlargement of the diaphyses of the long bones (Amorphous increase in density of the base of the skull in two cases)
- 3 Thickening of the cortex by endosteal and periosteal accretion of mottled new bone without recognizable trabecular pattern
- 4 Abrupt demarcation of the lesion, the involved cortex being irregularly denser, with loss of normal trabeculation
- 5 Progression of the lesion along the long axis of the bone in both proximal and distal directions, with gradual alteration of previously normal bone
- 6 Elongation of the extremities relative to the size of the child
- 7 Soft-tissue changes similar to those of underdevelopment of muscles and malnutrition
- 8 Normal epiphyses and metaphyses

#### PATHOLOGICAL ASPECTS

The material for pathologic study obtained in the first two patients early in the

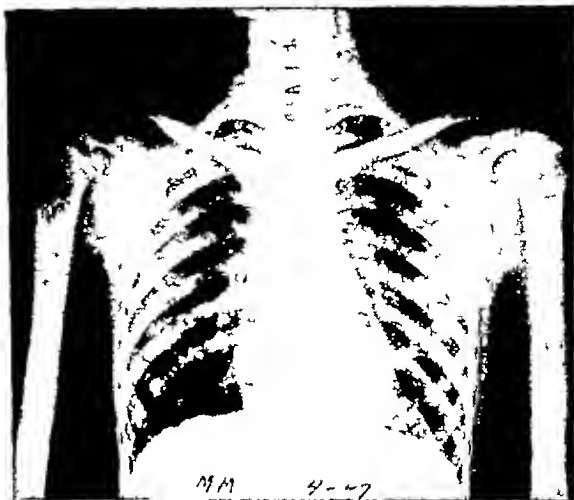


Fig 4 Case 1 M M Chest, showing symmetrical involvement of humeri and clavicles, ribs and spine appear normal

disease is quite similar (Fig 5, A). The only gross findings are a markedly thickened bony cortex with some thickening of the periosteum. Microscopically, there is an increase in the fibrous component of the periosteum and marked osteoblastic as well as osteoclastic activity. In some regions, the osteoblasts are applied to the external bone surface in cell layers three or four deep. Other areas show rows of osteoclasts and Howship's lacunae on the external bony cortex. The area of outer circumferential lamellae is thinner than usual or else entirely absent. The haversian systems are well formed but the canals often appear larger than usual and sometimes lined at the periphery by osteoclasts. In these early biopsies no fibrous marrow is evident. The muscles and subcutaneous tissues are not remarkable histologically.

A subsequent biopsy (six years later) on patient M M (Fig 6) demonstrates loss of cortical compact bone. Only a very thin subperiosteal layer remains, on which thickening of the periosteum is again evident grossly. The cortex presents a pebbly surface. Microscopically normal compact bone structure is absent. In its place there is a lacy cancellous bone whose trabeculae are thin and show increased osteoblastic and osteoclastic activity in different areas. The marrow con-

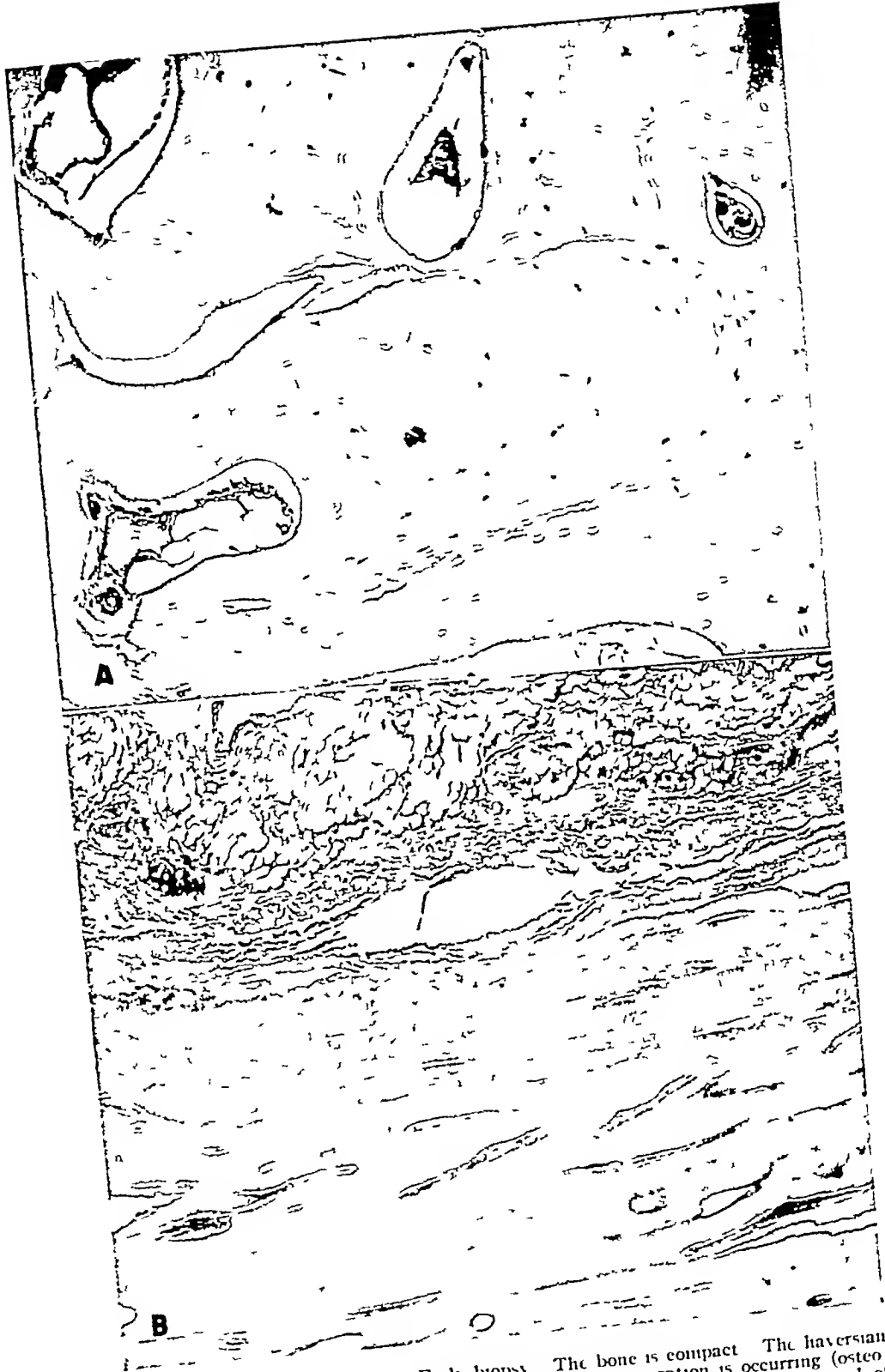


Fig 5 A Case 1 M M Early biopsy The bone is compact The haversian systems are well formed Each haversian canal shows resorption is occurring (osteoclasts are present) No fibrous marrow is seen (By courtesy of American Journal of Diseases of Children)

B Case 4 N P The cortical bone is still compact but shows numerous active haversian canals penetrating it The walls of these canals often show resorption (lower left) The periosteum is thick and shows resorption as well as formation under it (resorption at the left) The vessels (upper left) show perivascular infiltration and (upper right) thickened walls



A



B

Fig 6 Case 1 M M Later biopsy specimens A Entire absence of cortical compact bone Lacy network shows active bony reconstruction (both formation and resorption) Conversion of fatty to fibrous marrow is evident Collections of mononuclear cells are seen in upper central portion of photomicrograph  
B Periosteum and bone underneath with active resorption evident Fibrous marrow is present and the haversian systems are poorly delineated

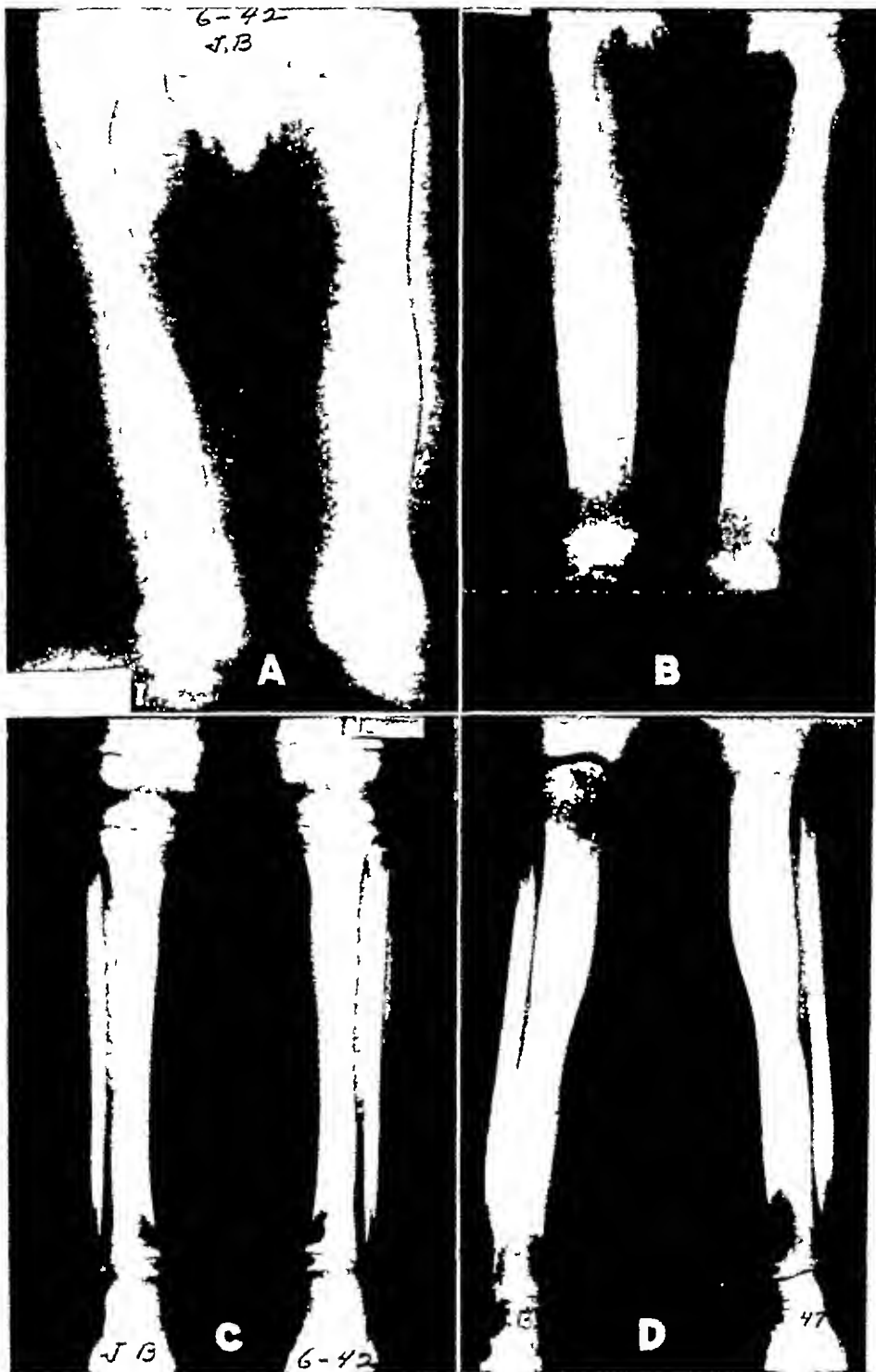


Fig 7 Case 2 J B Progressive changes in the long bones of the lower extremities during a five year period. The symmetrical clearly demarcated fusiform enlargement of the diaphyses is produced by accretion of endosteal and subperiosteal new bone of an amorphous character progressing along the long axis of the bone involving previously normal cortex. Other long bones are similarly involved as shown in Fig 2 A A and C June 1942 B and D May 1947

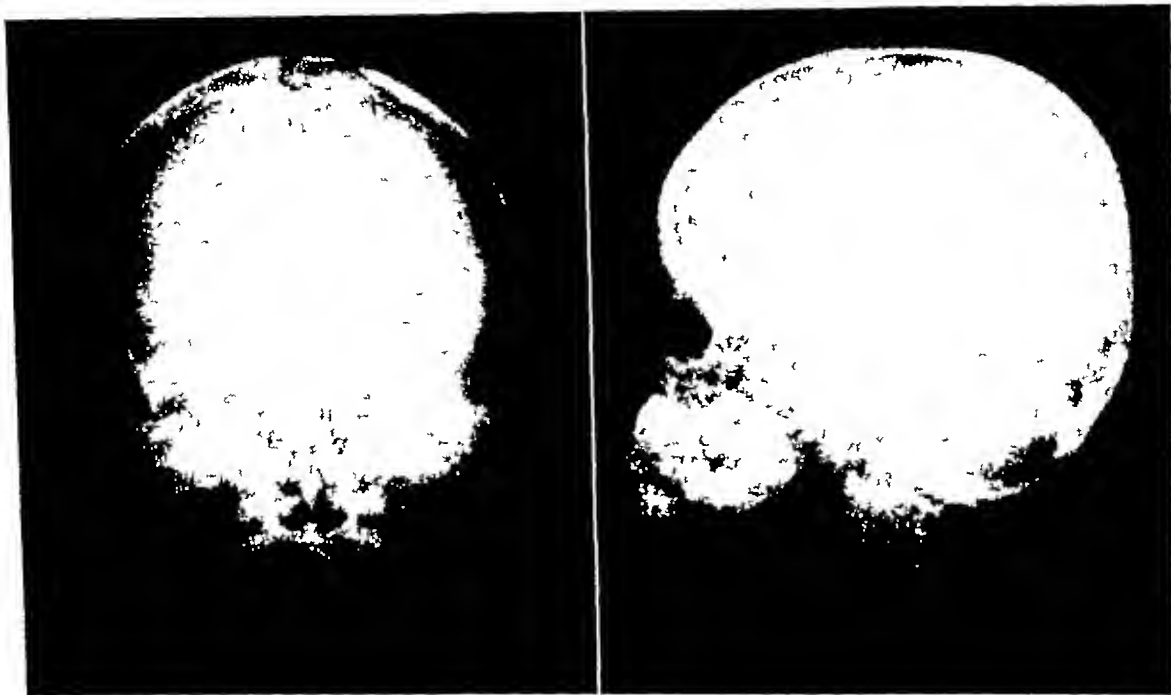


Fig 8 Case 2 J B Skull, showing amorphous increase in density of base

sists, in the main, of a loose mesenchymal type of fibrous tissue with occasional foci of hematopoiesis and a few fat cells. In several areas small collections of mononuclear cells resembling macrophages are seen, but without evidence of phagocytosis. No giant cells are present. A slight increase in the number of plasma cells and in the thickness of the vessel walls is evident. This probably indicates the chronicity of the lesion. The area described comes from the ulna at a point which radiologically seems to show a transition from less involved to more involved bone. Histologically this transition is seen to consist of a progressive generalized thinning of the cancellous bone trabeculae, but no normal cortical compact bone is present in any part of the section.

The biopsy specimen from patient N P (Fig 5, B) demonstrates an intermediate stage between those previously described as the progress of the disease is visualized. The cortex, while compact, shows gradual transformation into a cancellous structure. The periosteum is thickened, and a few vessels show medial and intimal proliferation. The lumens of some of the vessels are com-

pletely obliterated. No active inflammation is present. The marrow is somewhat fibrous but shows normal hematopoietic elements.

In summary, pathologically these cases present a thickening of the periosteum, beneath which is an altered cortex with evidence of progressive active bone resorption as well as deposition. A later biopsy shows the result of combined resorption and deposition in that the bone is completely altered from a compact to a cancellous type. In the marrow there also is a change from the normal fatty type with occasional hematopoietic foci to a loose fibrous tissue with collections of mononuclear cells and hematopoietic cells in small numbers. All of these changes are considered to be non-specific and possibly merely accompany resorption and remodelling. No cartilaginous elements are seen in the involved tissues. The findings of vascular thickening, up to obliteration of the lumen, and of perivascular lymphocytes are considered non-specific. These last findings are minimal and hardly of sufficient magnitude to be considered of etiological significance.

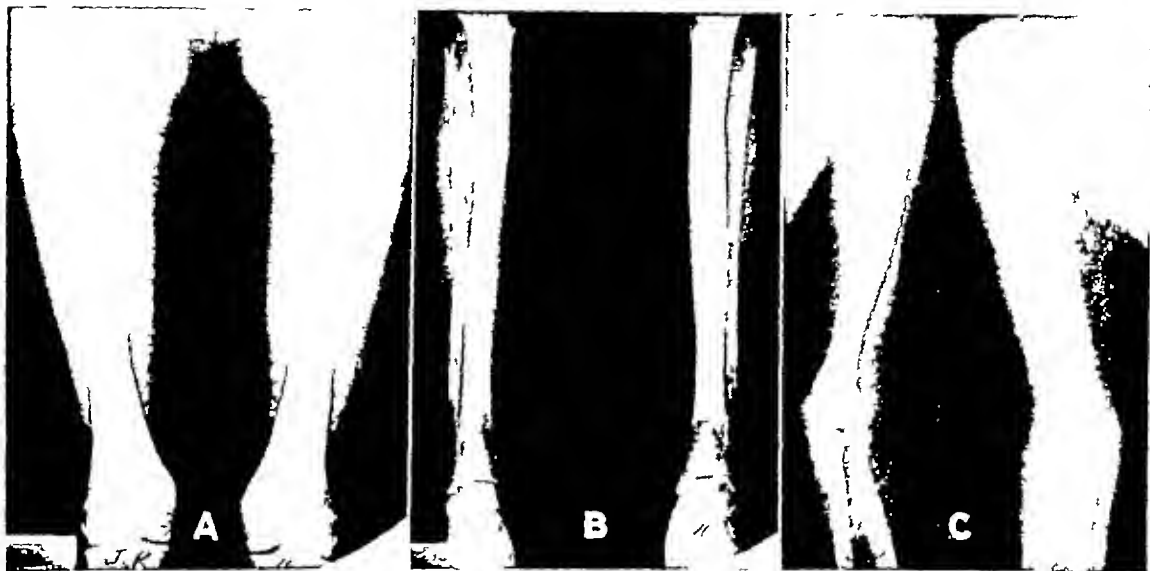


Fig 9 Case 3 J K Long bones showing changes identical to the early changes of the two previously described patients The skeletal involvement is illustrated in Fig 2 A

#### DISCUSSION

These cases have been termed progressive diaphyseal dysplasia to describe the continuous change in structure of the long bones. The epiphyses and metaphyses are seemingly uninvolved while the diaphyses show a progressive broadening with alteration of the bony cortex, which includes more and more of the shaft. As determined by measurement from the nutrient foramina in successive roentgenograms, the involvement of bone spreads both toward the uninvolved central shaft and toward the metaphysis (Figs 3 and 7).

These cases differ from the fibrous dysplasias of bone of the polyostotic type described by Lichtenstein and Jaffe, and Fuller Albright and associates, in that (a) the osseous changes are not predominantly unilateral in distribution, (b) they are characterized by subperiosteal new bone, while in fibrous dysplasia this is never seen without associated fractures, (c) pathologically there is no replacement of bone by dense fibrous tissue. The presence in two of our cases of skull findings (Figs 2, A and 8) similar to those often seen in polyostotic fibrous hyperplasia is of interest.

These lesions are unlike the conversion abnormalities of enchondromatosis and

Ollier's disease in that (a) previously normal bone precedes these lesions, (b) the changes are progressive, (c) there is no cartilage present on pathologic study.

The lesions are similar to the fundamental processes of Paget's disease in that the cortical architecture is progressively altered. However, the process differs from Paget's in that radiologically there is no coarse accentuation of the trabecular pattern along the weight-bearing lines. In fact, the new cortical bone is characterized by the very lack of a radiological pattern and by an irregularly amorphous increase in density. In addition, the serum alkaline phosphatase in three of the four cases presented is normal and is only slightly elevated in the fourth. Finally, the microscopic appearance does not show the pathognomonic mosaic patterning of Paget's disease.

Despite microscopic appearances similar to infantile cortical hyperostosis, this lesion differs in (a) age incidence, (b) distribution (infantile cortical hyperostosis shows preference to mandible, ribs, and clavicles), (c) symmetry of involvement, and (d) progressive nature (infantile cortical hyperostosis appears to be self-limited). Finally, these cases should be distinguished from the diaphyseal dysplasia of

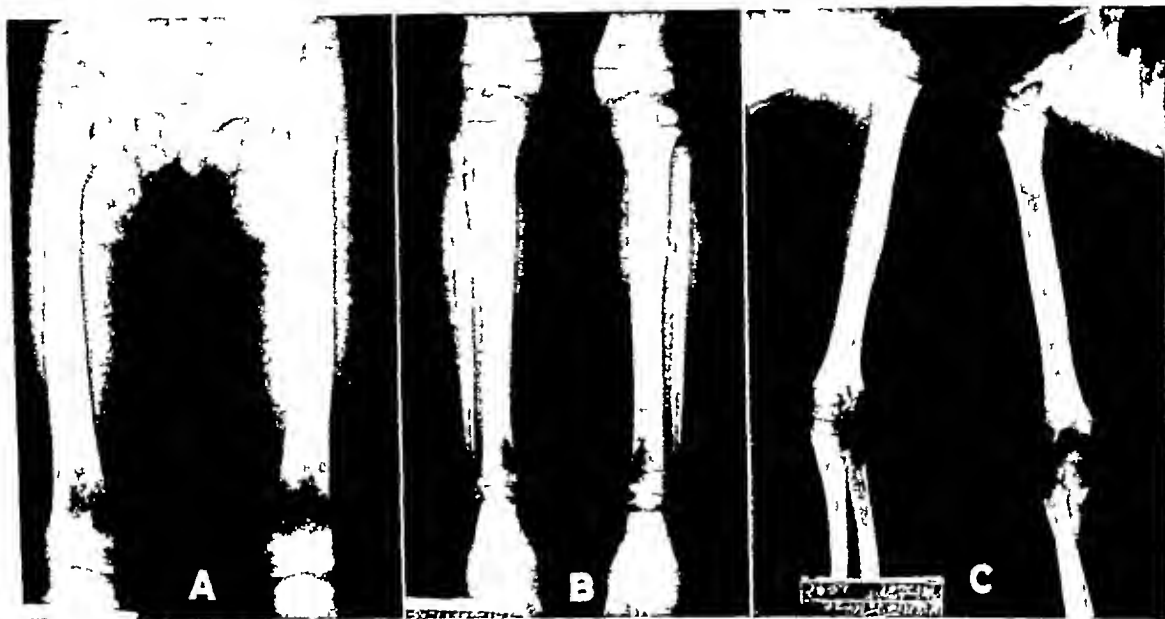


Fig 10 Case 4 N P Roentgenograms showing moderately early involvement of diaphyses of the long bones. There was also early involvement of the base of the skull with skeletal involvement as shown in Fig 2 A

Caffey, in that no heredity influences are evident

Microscopic study of biopsy specimens reveals that the cortical bone is being altered fairly rapidly to bone of a cancellous type, while the periosteum is actively laying down new bone. The marrow has been converted from the usually fatty type to a mesenchymal tissue with a few foci of mononuclear cells as well as hematopoietic cells. This type of marrow is characteristic of areas in which reconstruction of bone is occurring rapidly. No clue concerning the etiology of the disease process is evident in the biopsy material. There is no evidence that suggests an inflammatory agent. Other speculative possibilities concerning etiology are inadequate, in the present status of our knowledge, to explain the production of such anomalies. The disturbance in bony architecture cannot be compared with any pattern which might result from distortion of normal growth mechanisms. Endochondral bone formation is obviously normal, as shown radiographically. The factors known to affect appositional bone formation and remodelling, e.g., vitamin effects and local inflammatory disease, should produce either more wide-

spread involvement on the one hand or less symmetrical distribution on the other.

The disease is evidently not limited to the bones, even though its progressive nature is most spectacularly recorded in them. The peculiar disturbances of motor function and particularly the inability to gain weight normally are evidence of a more widespread disease process.

#### SUMMARY

A syndrome characterized by progressive symmetrical alterations in the diaphyses of long bones is presented. Four cases are described, three of which have been followed for more than five years. The clinical findings in these cases consist mainly of retardation of growth in height and weight and muscular weakness. No constant laboratory data of significance have been elicited. Biopsies in three of the four cases show diffuse non-specific bony changes. The etiology is obscure. A descriptive term for this syndrome is progressive diaphyseal dysplasia.

ADDENDUM Since this paper was submitted a case has been reported by H R Sear in the *British Journal of Radiology* (21 236, May 1948), entitled 'Engel-

mann's Disease or Osteopathia Hy perostotica Scleroticans Multiplex Infantilis " This appears to be identical with the condition we have described Sear also mentions a report by G Engelmann in the *Fortschritte a d Geb d Röntgenstrahlen* (39 1101, June 1929), thus bringing the total reported cases to six

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#### REFERENCES

RILEY C M, AND SHWACHMAN, H Unusual Osseous Disease with Neurologic Changes *Am J Dis Child* 66 150-154, 1943

LICHTENSTEIN, L, AND JAFFE H L Fibrous Dysplasia of Bone *Arch Path* 33 777-816, 1942

ALBRIGHT, F, BUTLER, A M, HAMPTON, A O AND SMITH, P Syndrome Characterized by Osteitis Fibrosa Disseminata Areas of Pigmentation and Endocrine Dysfunction, with Precocious Puberty in Females *New England J Med* 216 727-746, 1937

CAFFEY J AND SILVERMAN, W A Infantile Cortical Hyperostoses *Am J Roentgenol* 54 1-16 1945

CAFFEY J *Pediatric X-Ray Diagnosis* Chicago Year Book Publishers Inc, 1945 p 643

WOLBACH, S B Vitamin-A Deficiency and Excess in Relation to Skeletal Growth *J Bone & Joint Surg* 29 171-192, 1947

BAKWIN, H, AND KRIDA, A Familial Metaphysal Dysplasia *Am J Dis Child* 53 1521-1527 1937

PYLE, E A Case of Unusual Bone Development *J Bone & Joint Surg* 13 874-876, 1931

#### SUMARIO

#### Displasia Diafisaria Progresiva

Preséntase un síndrome caracterizado por alteraciones simétricas evolutivas en las diáfisis de los huesos largos Describense cuatro casos, tres de ellos observados más de cinco años En esos casos los hallazgos clínicos consisten principalmente en retardo del desarrollo de la talla y el peso y extenuación muscular No se

descubrieron datos constantes de laboratorio que tuvieran importancia Las biopsias realizadas en tres de los cuatro casos revelan alteraciones óseas difusas anespecíficas La etiología es incierta Un término descriptivo de este síndrome es displasia diafisaria progresiva



# Obstructions of the Alimentary Tract in Infancy<sup>1</sup>

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WITH THE improvements, during recent years, in the control of infectious and nutritional diseases the subject of congenital malformations becomes of increasing importance to the pediatrician. In many respects this is a discouraging field and probably at best only a small percentage of malformations will be found amenable to satisfactory correction. Many lesions, however, once considered hopeless are now being cured as a result of more accurate methods of diagnosis and advances in surgical technic. Everyone has been impressed by the surgical procedures for the relief of congenital cardiovascular malformations developed during the past decade. Malformations of the alimentary tract are of comparable importance and are certainly to no lesser degree amenable to correction.

It is the purpose of this communication to review the general field of alimentary obstructions in infancy and to consider the differential diagnosis, particularly by radiological methods. The distribution of the more common obstructing or potentially obstructing lesions observed in 400 infants during the past seven years at Children's Hospital of Michigan is shown in the accompanying table. Although the atresias, meconium ileus, obstructing bands, and volvulus comprise only 22 per cent of the series, this group is of relatively greater importance to the radiologist. They represent diagnostic problems for which radiological help is sought, while only 19 per cent of the cases of pyloric stenosis, 30 per cent of the cases of intussusception and practically no cases of strangulated hernia are referred for radiological study.

The age of the patient is often an important consideration in pediatric diagnosis, and this is particularly so in alimentary lesions. In Figure 1 the age distribution

## APPROXIMATE INCIDENCE OF ALIMENTARY OBSTRUCTIONS IN 400 INFANTS

Hypertrophic pyloric stenosis	50%
Intussusception	20%
Atresias	16%
Esophagus	4%
Duodenum	2%
Jejunum-ileum	3%
Colon rectum	2%
Anus	5%
Strangulated hernia	8%
Meconium ileus	2%
Congenital bands	2%
Volvulus	2%

for three large groups of obstructing lesions is represented diagrammatically. The atresias, meconium ileus, and most cases of volvulus are seen during the first few days of life. Hypertrophic pyloric stenosis usually occurs between three and ten weeks of age, while intussusception is rare under three months and attains a peak incidence at five months of age. It will be noted that there is little overlapping of these three groups, so that an appreciation of the age alone may be helpful in diagnosis.

## INFANTILE HYPERTROPHIC PYLORIC STENOSIS

Infantile hypertrophic pyloric stenosis is the most common of the obstructing lesions under consideration and the one least often subjected to x-ray examination. The clinical diagnosis, based on the character of vomiting and palpation of a tumor, is usually considered sufficiently accurate for operation. In the series considered here, barium studies were done in only 15 per cent.

Under favorable conditions, a precise anatomical diagnosis can be made by x-ray examination in doubtful cases. For this study, the stomach should be free of gas, mucus, and food, and this usually requires careful aspiration and lavage before the examination. A small amount (5-10 cc) of thick barium paste is recommended for

<sup>1</sup> From the Children's Hospital of Michigan, Detroit, Mich. Read in part at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30-Dec. 5, 1947.

visualization of the stomach, pylorus, and duodenum. The stomach is observed fluoroscopically until barium first enters the duodenum. Serial films are then made in the right anterior oblique projection. A persistently long narrow pyloric canal is positive evidence of hypertrophy of the pyloric muscle. The technic is that of Meuwissen and Slooff (1931) (1), which was used without error by Hefke in 150 cases reported in 1944 (2).

The adjective "congenital" is commonly used for this lesion, but perhaps erroneously. It certainly behaves quite differently from true congenital lesions, and symptoms are very rarely if ever present at birth. Wallgren (3) examined 1,000 newborn male infants by the technic described above and in every instance found a normal pylorus. On a statistical basis, 6 of the 1,000 might be expected to acquire pyloric stenosis, the incidence being 1/150.

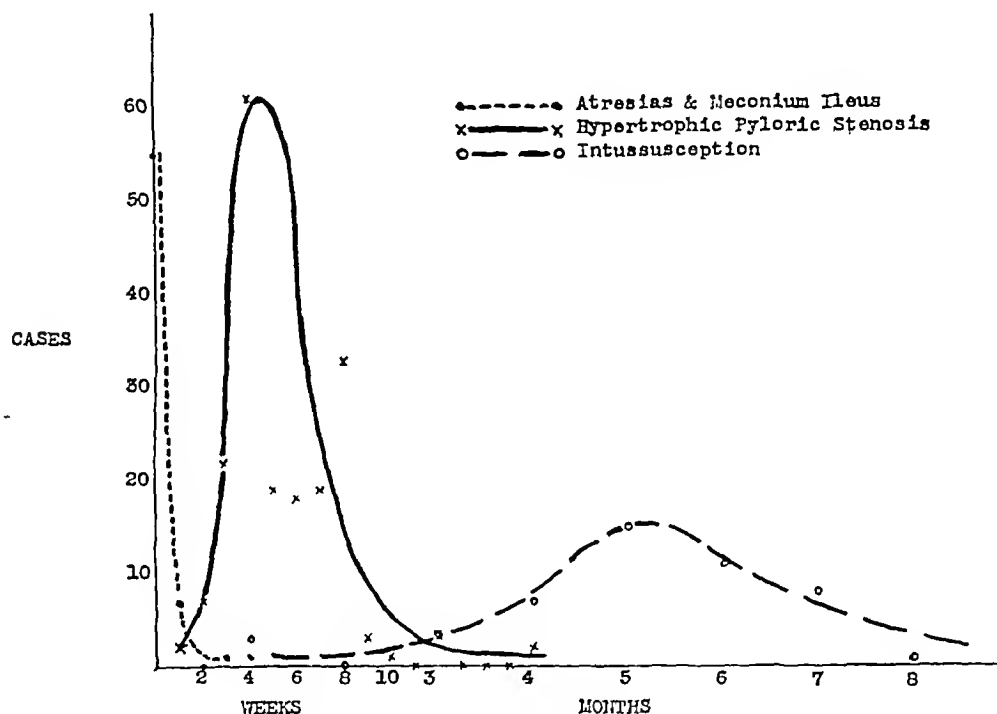


Fig 1 Age incidence of obstructing lesions in infancy

Figure 2A shows the normal appearance of the infantile stomach, pylorus, and duodenum. In Figure 2B the difficulty of examining a stomach distended by retained gas and liquid is illustrated, with the result of a subsequent study after aspiration and lavage, showing the long narrow pylorus characteristic of hypertrophic pyloric stenosis. The impression of the hypertrophied muscle upon the base of the duodenal bulb is to be noted. The dangers of fasting, aspiration of barium, and inspissation of barium, often given as contraindications to barium studies, have not been realized in our experience.

male infants in Sweden. Five did so, with the radiographic appearance of an hypertrophied pyloric muscle. Without denying that there may be familial and constitutional factors, one may prefer the term "infantile hypertrophic pyloric stenosis" as more accurately descriptive of the lesion.

#### INTUSSUSCEPTION

In intussusception, also, the diagnosis is usually made clinically from a history of colicky abdominal pain, shock, and the appearance of bloody stools. Fourteen per cent of the patients in this series were examined by x-ray without contrast media,

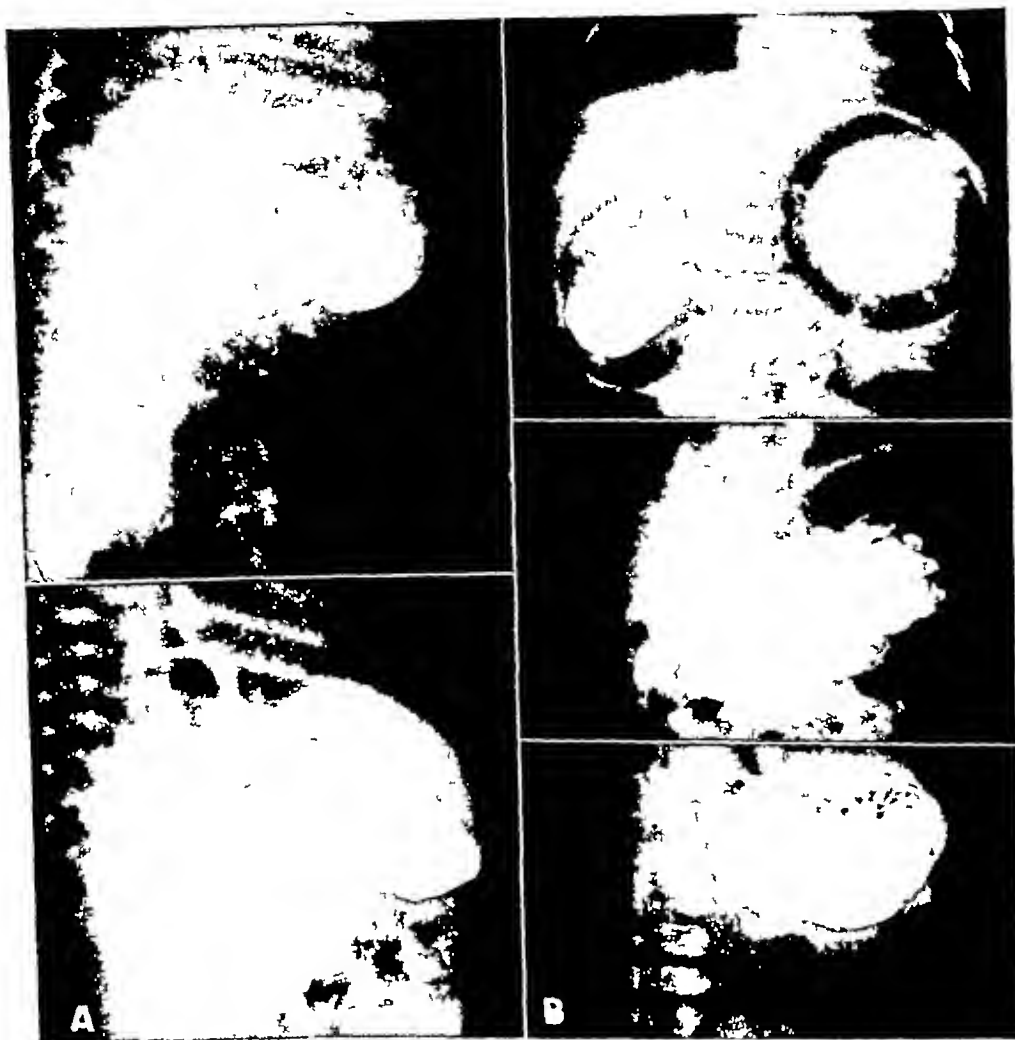


Fig 2 A Normal appearance of the infantile stomach, pylorus, and duodenum in two patients  
 B Infantile hypertrophic pyloric stenosis The upper two studies illustrate the difficulty of examining the infantile stomach distended by gas and liquid The lowermost study made in the same patient following aspiration and lavage of the stomach shows the elongated narrow pyloric canal characteristic of infantile hypertrophic pyloric stenosis

and 16 per cent following the injection of air or barium into the colon. Air may give a satisfactory visualization of the intussusceptum if obstruction has not yet occurred with gaseous distention of the small bowel, as in Figure 3, but in general barium is a more reliable contrast medium and the pressure of the injection can be better controlled. The barium enema study indicates the extension of the intussusceptum into the colon and the degree of gaseous distention of the small bowel, which are factors in the prognosis. Furthermore, the intussusception may be partially reduced by the procedure, which is of considerable assistance

to the surgeon, or the reduction may even be complete.

In Figure 4A, the intussusceptum is seen in the transverse colon, where it was found at operation and easily reduced. In Figure 4B, the intussusceptum is visualized in the ascending colon, but at operation reduction was found to have already occurred. This is not an uncommon experience. In the case illustrated by Figure 4C, complete reduction had occurred following the barium enema study, in spite of the evidence of marked obstruction indicated by the gaseous distention of the small bowel. In these cases the barium enema



Fig 3 Intussusceptum visualized in the ascending colon by an air enema

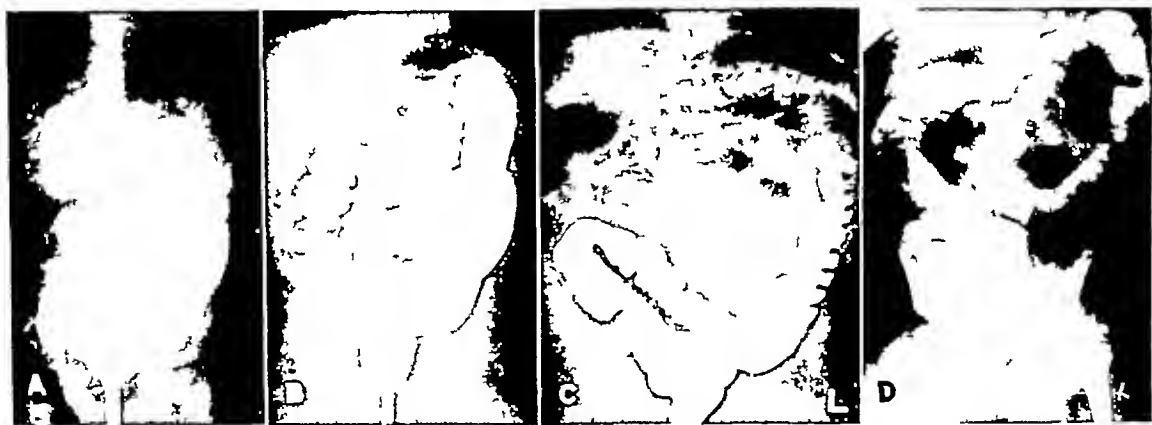


Fig 4 A Intussusceptum visualized by barium enema in the distal part of the transverse colon where it was found at operation and easily reduced

B Intussusceptum visualized in the ascending colon At operation the intussusception was found to be completely reduced

C Intussusception with marked gaseous distention of the small bowel, indicating obstruction At operation the intussusception was found to be completely reduced

D Intussusceptum visualized in the ascending colon At operation the colic aspect of the intussusception was found to be reduced but there was a necrotic hemorrhagic mass of ileo ileal intussusception which required resection

was used for diagnosis and not with the intent of reducing the intussusception

The treatment of intussusception by barium enema has been recommended by several observers abroad but seldom in this country Hellmer (4) reported in 1943 that he had obtained a complete reduction by

barium enema in 80 per cent of 110 intussusceptions He recommended a pressure of less than 15 mm his criterion of reduction being a normal filling of the terminal ileum The unsuccessfully treated patients referred to the surgeon gave him a much higher operative mortality but the total

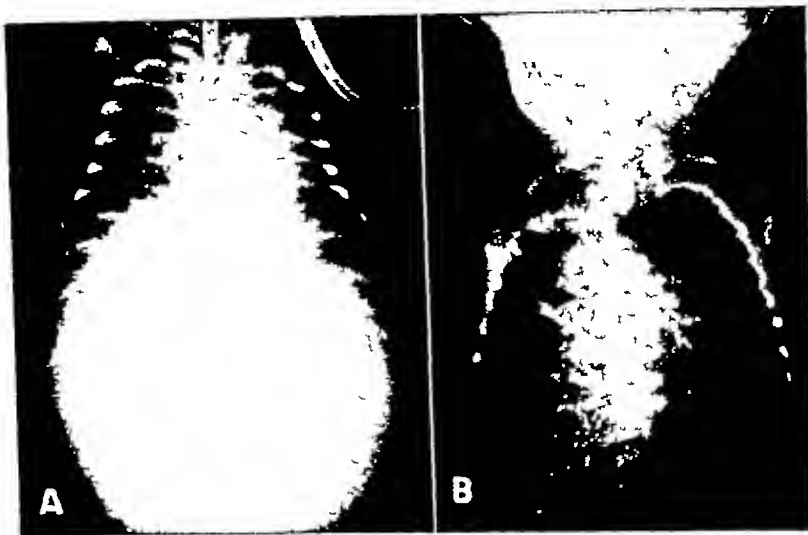


Fig 5 A Esophageal atresia The tip of the catheter in the esophagus indicates the lower end of the proximal segment Absence of air in the stomach and bowel indicates the lack of communication between the pharynx and abdominal viscera

B Esophageal atresia of the common type visualized by lipiodol in a blind pouch terminating at the level of the second dorsal vertebra Lipiodol has been aspirated to produce a bronchogram and some of the lipiodol has passed into the lower esophageal segment through the fistulous communication at the tracheal bifurcation

mortality compares favorably with reports in this country, where the treatment has been almost entirely surgical Retan (5) recommended that reduction by barium enema not be attempted unless the patient is seen with symptoms of less than twelve hours duration The principal hazard is in the rare cases of ileo-ileal intussusception In Figure 4D, the colic aspect of the intussusception was found reduced at operation but there was a hemorrhagic necrotic mass of ileo-ileal intussusception which required resection Perhaps this might have been recognized if there had been a more determined effort to visualize the small bowel

#### ATRESIAS

*Esophagus* Atresia of the esophagus always seems to occur at about the level of the second dorsal vertebra It should be suspected in the newborn from the appearance of abundant frothy mucus in the mouth, and food as well as barium should be withheld An opaque catheter passed into the esophagus will indicate the characteristic site of obstruction, as in Figure 5

A This case is one of the unusual types in that there is no communication between the pharynx and abdominal viscera, as indicated by the complete absence of gas in the stomach and bowel The more common type is illustrated in Figure 5B, with the blind pouch of the upper esophageal segment filled with lipiodol, the lipiodol spilling over into the bronchial tree and outlining the lower esophageal segment, which has a fistulous communication at the tracheal bifurcation

*Duodenum* Atresia of the duodenum produces a characteristic roentgenographic appearance without the use of contrast media other than gas, which distends the stomach and the duodenum proximal to the atresia, as in Figure 6A The absence of gas in the lower small bowel and colon indicates complete obstruction, and the surgical indications are clear Figure 6B illustrates an atresia a little further down, in the first part of the jejunum, and the failure to obtain any additional information from the injection of lipiodol

*Ileum* Ileal atresias are more difficult to recognize and may be indistinguishable



Fig 6 A Duodenal atresia Gas-distended stomach and proximal duodenum with absence of gas distally, indicating complete obstruction in the duodenum The diagnosis of atresia was verified at operation

B Jejunal atresia The location of the obstruction is well indicated by gas in the stomach and duodenum Lipiodol given by mouth yields no additional information Atresia was found at operation 1-1 1/2 inches below the ligament of Treitz

C Ileal atresia The gas-distended bowel is longer than in A and B The barium enema establishes the patency of the colon and the absence of a gross malrotation



Fig 7 A Meconium peritonitis and atresia of terminal ileum Linear calcification is seen in the right flank A walled-off meconium abscess and extensive peritoneal adhesions were found at operation and autopsy

B Meconium peritonitis and atresia of the mid ileum An abscess cavity with calcareous deposits in the wall was found in the right side of the abdomen at autopsy

radiologically from meconium ileus and volvulus Indeed, atresia, meconium ileus, and anomalous insertions of the mesentery are often combined In this situation we avoid barium by mouth but customarily use the barium enema to determine whether the gaseous distention is confined to the small bowel and to locate the cecum for evidence of a malrotation pointing to volvulus

Figure 6C illustrates an atresia near the jejuno-ileal junction with several gas distended loops of small bowel The presence of gas in the colon and malrotation of the colon are excluded by the barium enema At operation an atresia was found with a local twist and malattachment of the mesentery

Atresias of the small bowel are often associated with perforation of a proximal



Fig 8 A Imperforate anus In the inverted position, the rectal pouch is distended by gas showing it to be in close approximation to the perineum, as was demonstrated at operation

B Imperforate anus and rectal atresia The gas distended rectal pouch was demonstrated in the inverted but not in the supine position The distance between the pouch and the perineum is greater than in A, and here a rectal atresia was found 2 inches above the perineum



Fig 8 C Imperforate anus Patency of the rectum is not demonstrated either in the inverted position or in the lateral position with the thighs flexed tightly against the abdomen At autopsy the rectum was found filled with meconium

loop producing peritonitis presumably in fetal life Neuhauser (6) has pointed out the radiological evidence for meconium or fetal peritonitis in calcification of the peritoneum This is shown in Figure 7A In this case operation and autopsy disclosed

atresia of the terminal ileum, partial rotation of the large bowel, and a walled off meconium abscess cavity in the right flank with innumerable peritoneal adhesions Figure 7B shows a similar case with atresia of the mid-ileum, malattachment of



Fig 9 A Stenosis of the ileum The first study shows no characteristic pattern of gas in the bowel The barium enema demonstrates markedly gas-distended loops of small bowel proximal to the terminal ileum and colon The diagnosis of partial obstruction in the ileum was confirmed at operation An intrinsic stenosis was found 30 inches proximal to the ileo cecal valve

B Peritoneal bands obstructing the duodenum The gas-distended proximal duodenum with small amounts of gas distally indicates a partial obstruction in the duodenum This diagnosis was verified at operation, and recovery occurred following severance of the obstructing peritoneal band

the mesentery, and plastic peritoneal exudate with calcareous deposits These two cases were examined within a few hours after birth, so that there can be no doubt but that the peritonitis had occurred during fetal life

*Rectum and Anus* Imperforate anus may, of course, be readily recognized by inspection and is often discovered upon attempting to introduce a rectal thermometer The purpose of the x-ray examination is to determine the extent to which the bowel is patent The method of Wangenstein and Rice is illustrated in Figure 8A, with the infant inverted the gas in the rectum is observed to extend to the perineum, indicating only a membranous veil at the anus Figure 8B shows the advantage of the inverted vertical position over the supine position In this instance, a rectal atresia was found about two inches proximal to the perineum The method is liable to error, however, in that gas may not displace meconium impacted in the rectum even after twenty-four hours Wilson recommends suspension in the inverted position for five to ten minutes Examination in the lateral projection with the knees flexed tightly against the abdomen has also been recommended Both of these

methods failed in the case illustrated by Figure 8C, but by the latter method meconium was forced through a minute opening in the perineum just posterior to the vagina Over 50 per cent of the cases of imperforate anus are accompanied by a fistulous communication with the perineum, vagina, or bladder In this instance the rectum was found quite patent at autopsy but filled with meconium

*Partial Obstructions* Brief mention should be made of partial congenital obstructions due to stenosis or peritoneal bands These cases are usually seen at a slightly later age period than the atresias and complete obstructions Figure 9A is from a case of ileal stenosis observed in a boy seven weeks old The barium enema study shows the gas-distended loops of small bowel not clearly evident as such in the preliminary film Figure 9B is from an infant three weeks of age who had been vomiting since birth Here there was an incomplete obstruction due to extrinsic bands compressing the duodenum just proximal to the ligament of Treitz Small amounts of gas in the lower small bowel show that obstruction is not complete and the gas-distended duodenum indicates that the obstruction is beyond the pylorus

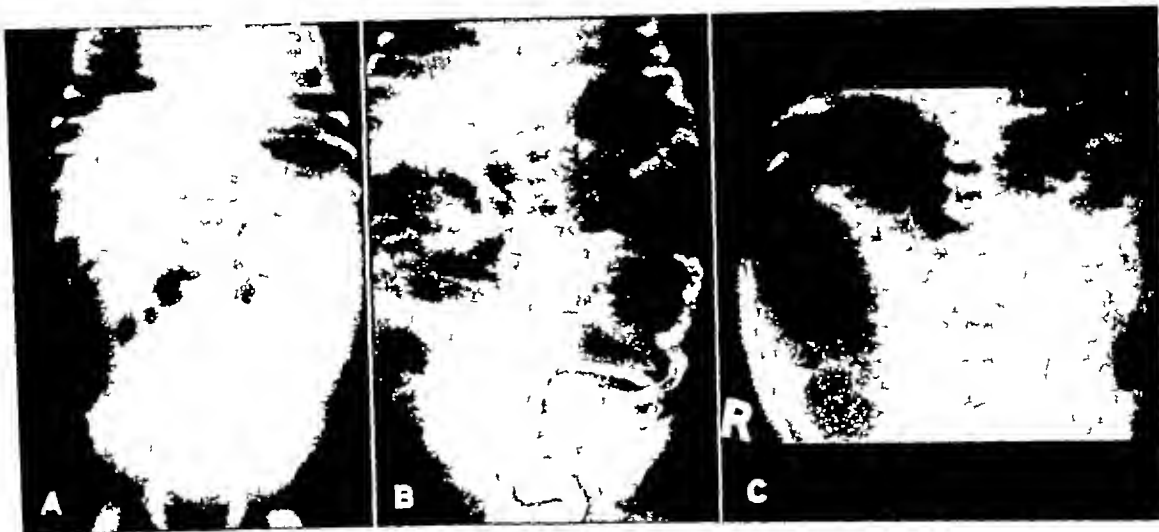


Fig 10 A Meconium ileus Gas distended loops of small bowel with a mottled appearance of the bowel in the left flank, as from small bubbles of gas mixed with meconium, is indicative of meconium ileus  
 B Meconium ileus Gas-distended small bowel and colon of small caliber This appearance would also be compatible with atresia of the lower ileum  
 C Meconium ileus, atresia of the ileum, and anomalous insertion of the mesentery

### MECONIUM ILEUS

The association of intestinal obstruction in the newborn with anomalies of the pancreas has been reported in isolated instances since 1900, but only in recent years has the frequency of the condition been appreciated from the studies of Andersen (8) and Farber (9) on fibrocystic disease of the pancreas. It is now understood that in this disease, manifesting itself in the newborn, the meconium is thick, viscid, and tenacious, either concomitant with or as the result of a deficiency in the excretion of pancreatic enzymes. The character of the meconium is such that it cannot be propelled by peristalsis, and obstruction results, usually with inspissation of meconium from the mid-ileum to the proximal colon. Differentiation from ileal atresia is difficult by x-ray examination, but Neuhauser (10) has pointed out that if there is no abrupt termination of the gas-distended bowel, and if there is a mottled appearance of the meconium as if by small bubbles of gas mixed with it, meconium ileus may be recognized. This is illustrated in Figure 10A. We have observed that in the examination by barium enema the colon appears of very small caliber, as it does at autopsy, and that the barium usually can-

not be forced much beyond the splenic flexure of the colon, as in Figure 10B. Figure 10C is from a case of meconium ileus, fibrocystic pancreas, atresia of the mid-ileum, and an anomalous insertion of the mesentery, illustrating how similar malformations may be combined.

### VOLVULUS

The basis for volvulus of the mid-gut in the newborn period is a malrotation of the colon. Strangulation is perhaps precipitated by the distention of the bowel from its fetal state in the passage of gas and food during the neonatal period and may be manifest by the appearance of blood in the stools. The barium enema will establish the anomalous position of the cecum, indicating a malrotation of the colon. Ladd and Gross (11) have pointed out that early in this condition there is evidence of obstruction in the duodenum, as in Figure 11A, while later the strangulated portions of the jejunum and ileum become markedly distended by gas, as in Figure 11B. Each of these infants was two days of age and in each case there were vomiting and bloody stools. The first child survived operation, the second died with gangrene of the small intestine.

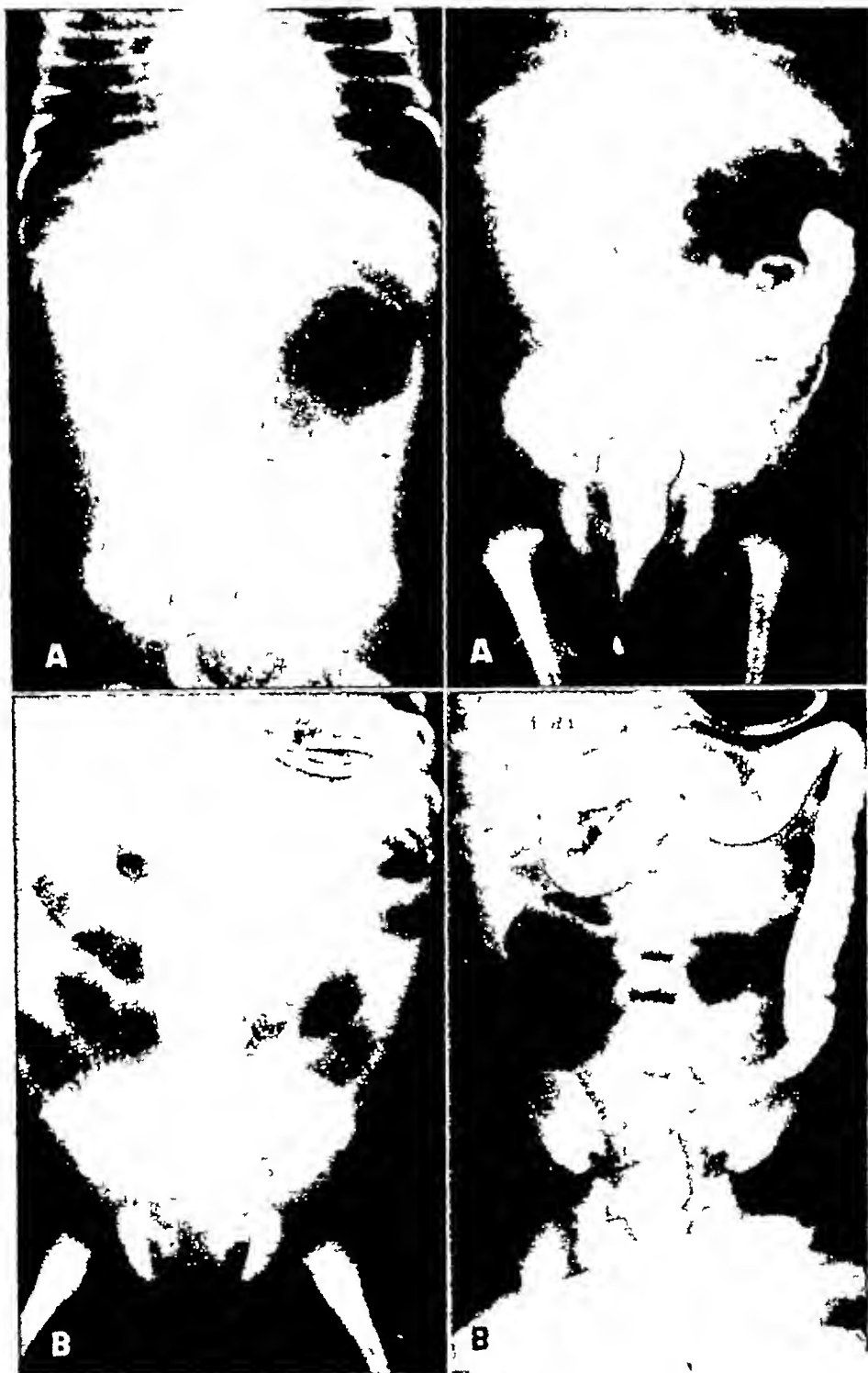


Fig 11 A Volvulus Duodenal obstruction and a high medial position of the cecum indicate volvulus of the small bowel  
 B Volvulus The high medial position of the cecum and gaseous distention of the small bowel indicate malrotation of the colon and strangulation of the small bowel due to volvulus



Fig 12 A Functional obstruction at the pylorus, probably secondary to intracranial injury at birth. No obstruction was found at autopsy but there was a hemorrhagic ulcerating gastritis and duodenitis.

B Functional obstruction in the lower bowel due to an anatomical defect of innervation.

#### FUNCTIONAL OBSTRUCTIONS

Mention should be made of conditions giving a clinical and radiographic picture of obstruction where actually no anatomical obstruction exists. Vomiting is common from intracranial injuries at birth. Usually there is no other evidence of obstruction but we have observed one instance, illustrated in Figure 12A, where there appeared to be complete obstruction at the pylorus. At autopsy a hemorrhagic ulcerating gastritis and duodenitis were found, such as has been previously seen in association with intracranial injury. In this case the appearance of blood in vomitus and stool and an appreciation of the fact that atresias and other organic obstructing lesions do not occur at the pylorus in the newborn might have indicated the correct diagnosis.

Obstruction may also occur in the lower ileum or colon from an absence or deficiency of nerve cells in the intestinal wall as in the cases recently reported by Zuelzer

and Wilson (12). This obstruction may be acute, recurrent, or chronic. In the case shown in Figure 12B death occurred fourteen days after birth from intestinal obstruction not relieved by ileostomy. The appearance here suggests an obstruction in the lower ileum as from atresia or stenosis, but no organic obstruction was discovered at operation or autopsy. Microscopic examination of the wall of the sigmoid colon and rectum showed an absence of ganglion cells, although small nerve trunks could be identified. This patient was one of five siblings who died of this disease from three days to four years of age. In the chronic cases the colon will be found enormously distended by gaseous and fecal material and the barium enema will show a very large colon, which may retain the barium for weeks or even months.

Diaphragmatic hernia in the newborn is usually manifested by difficulty in swallowing or respiration. The diagnosis in the case illustrated by Figure 13A was not

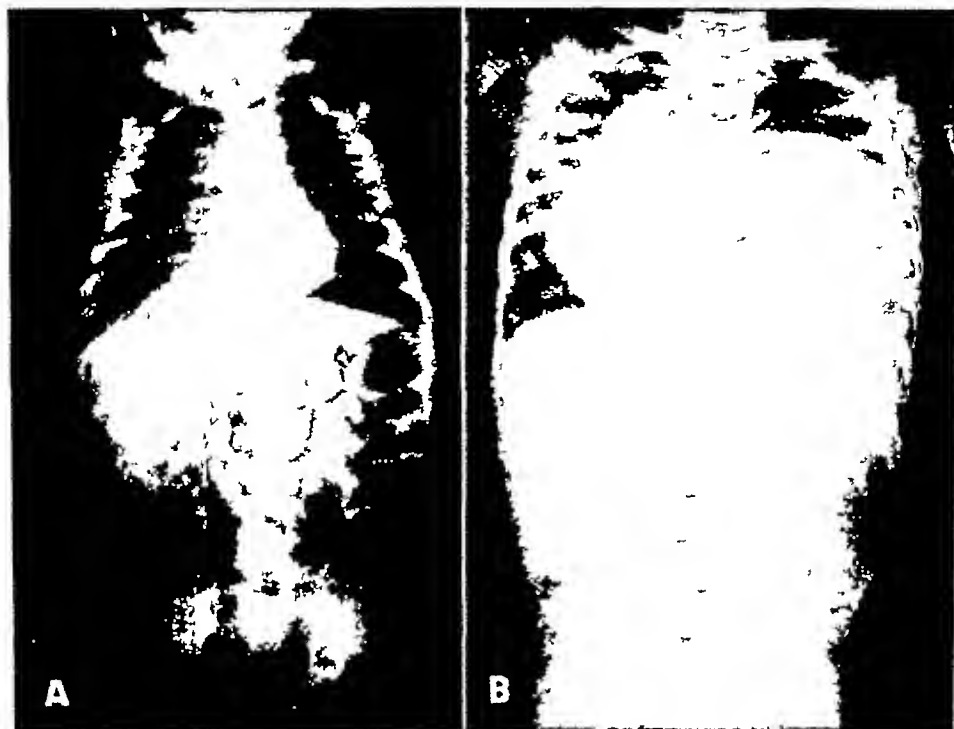


Fig 13 A Diaphragmatic hernia with no obstruction  
 B Diaphragmatic hernia with obstruction at the pylorus and marked distention of the stomach. Later perforation of the stomach occurred with a fatal outcome

suspected clinically or in the first x-ray examination, which is not surprising from the size and position of the hernia. When barium was given by mouth as part of a more complete routine x-ray examination of the chest, the diagnosis became evident. Frank obstruction of the alimentary tract is apparently not common in diaphragmatic hernia, but we have observed one such instance in the case illustrated by Figure 13B. This patient, a girl one and one-half years old, had a diaphragmatic hernia which had been recognized in the neonatal period. A torsion or compression had occurred at the pyloric end of the stomach, resulting in marked distention and later perforation of the stomach, with a fatal outcome.

#### REFERENCES

- 1 MEUVISSEN, T AND SLOOFF J. Roentgen Examination of Pyloric Canal of Infants with Congenital Hypertrophic Pyloric Stenosis. *Am J Dis Child* 48: 1304-1315 1934
- 2 HEFKE H W. Roentgen Diagnosis of Hypertrophic Pyloric Stenosis in Infants. *Radiology* 43: 267-271 1944
- 3 WALLGREN A. Preclinical Stage of Infantile Hypertrophic Pyloric Stenosis. *Am J Dis Child* 72: 371-376, 1946
- 4 HELLMER H. Roentgenologic Diagnosis and Treatment of Intussusception in Children. *Acta radiol* 24: 235-258, 1943
- 5 RETAN, G M. Nonoperative Treatment of Intussusception. *Am J Dis Child* 33: 765-770, 1927
- 6 NEUHAUSER, E B D. Roentgen Diagnosis of Fetal Meconium Peritonitis. *Am J Roentgenol* 51: 421-425, 1944
- 7 WILSON A K. Roentgen Examination in Congenital Obstructive Defects in Infants. *Am J Roentgenol* 54: 498-502 1945
- 8 ANDERSEN, D H. Cystic Fibrosis of the Pancreas and Its Relation to Celiac Disease, A Clinical and Pathological Study. *Am J Dis Child* 56: 344-399, 1938
- 9 FARBER S. Medical Progress. Pancreatic Insufficiency and the Celiac Syndrome. *New England J Med* 229: 653 682 1943
- 10 NEUHAUSER, E B D. Roentgen Changes Associated with Pancreatic Insufficiency in Early Life. *Radiology* 46: 319-328, 1946
- 11 LADD W E, AND GROSS, R E. Abdominal Surgery of Infancy and Childhood. Philadelphia W B Saunders Company, 1941 Chapter V
- 12 ZUELZER, W W, AND WILSON, J L. Functional Intestinal Obstruction on a Congenital Neurogenic Basis in Infancy. *Am J Dis Child* 75: 40-64, 1948
- 10 Peterboro  
 Detroit 1, Mich

## SUMARIO

## Obstrucciones del Aparato Digestivo en la Infancia

Al repasar todo el campo de las obstrucciones del tubo alimenticio en la infancia, se concentra la atención en el diagnóstico diferencial con técnicas radiológicas. La serie observada comprende 400 casos. Aunque sólo representan 22 por ciento del total, las atresias, el cólico mecánico, las bridas obstructoras y el vólvulo revisten, radiológicamente, la mayor importancia, pues constituyen los casos enviados más frecuentemente para estudio roentgenológico.

En la estenosis hipertrófica del píloro en el niño, el diagnóstico clínico suele considerarse suficiente. El signo radiológico patognomónico es un persistente alargamiento y estrechez del conducto pilórico observable en películas seriadas tomadas en proyección oblicua anterior derecha después de administrar una pasta espesa de bario (5 a 10 cc). Por lo general, se necesitan aspiración y lavado del estómago para desembarazarlo de gases, mucosidades y alimento.

En la invaginación también suele hacerse el diagnóstico clínicamente. El estudio con un enema de bario indica la extensión de la intususcepción en el colon y el grado de la distensión gaseosa del intestino delgado, factores estos que intervienen en el pronóstico. El enema de bario puede ir seguido de reducción, parcial o total.

En la atresia del esófago, se suprime el bario. Una sonda opaca introducida en el esófago indicará el sitio de la obstrucción. La atresia del duodeno produce un característico cuadro roentgenológico, sin usar

más medios de contraste que gas, que distiende el estómago y la porción del duodeno proximal a la atresia. La ausencia de gas en la porción inferior del intestino delgado y el colon indica obstrucción total. Cuando se sospecha atresia del ileon, administrase un enema de bario para determinar si la distensión gaseosa se limita al intestino delgado y para localizar el ciego en busca de signos de malrotación que denoten el vólvulo. En presencia de atresia del ano, el examen radiológico tiene por fin determinar cuanta permeabilidad intestinal existe. Más de 50 por ciento de los casos de imperforación anal van acompañados de fístulas que comunican con el perineo, la vagina o la vejiga.

El cuadro roentgenológico del cólico mecánico puede semjar íntimamente el de la atresia del ileon. El aspecto moteado del meconio y la falta de la terminación brusca del intestino distendido por gas sugieren el diagnóstico. En el examen con el enema de bario, el colon revela un calibre pequeño y no puede forzarse al bario mucho más allá de la flexura esplénica.

El vólvulo se basa en una malrotación del colon, lo cual puede establecerse por la posición anómala del ciego, según revela el estudio con un enema de bario. Hay signos tempranos de obstrucción duodenal, más tarde, las porciones estranguladas del yeyuno y el ileon aparecen distendidas por gas.

Hay que tener presente la posibilidad de obstrucción funcional, y se presentan dos casos de ese género.

# Fibrocystic Disease of the Pancreas<sup>1</sup>

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FIBROCYSTIC pancreatic disease is a congenital, familial, highly fatal disease of infants, regularly accompanied by pulmonary changes which are demonstrable in the roentgenogram. It is generally considered to be of rather infrequent occurrence, but it is likely that it is the diagnosis, rather than the disease, which is uncommon, and that many poorly explained deaths of infants from malnutrition, pneumonia, and diarrhea should, in fact, be attributed to pancreatic fibrocystic disease. Autopsies on babies indicate that it accounts for perhaps 4 per cent of all infant deaths.

The disease has become recognized as a clinical entity only in the past ten years, and its recognition is due almost entirely to the work of Dorothy Andersen (1). Probably the first description was that given by Garrod and Hurler (2), who recognized the co-existence of celiac-like disease with severe respiratory infection. Six years later, Passum (3) described typical findings of cystic fibrosis in a child who had abnormal stools. Accounts of this or of similar diseases appeared sporadically until 1938, when Andersen published her definitive paper with 49 cases proved at autopsy, classifying them in three groups. It is not surprising that recognition has been tardy, since the disease manifests itself almost entirely as a combination of respiratory tract disease and a feeding problem, and both the symptomatology and the course can be well explained on that basis.

The cause of fibrocystic disease of the pancreas remains unknown. It seems probable that it is of congenital origin, a theory supported by its usual occurrence in the newborn and its tendency to occur in more than one child in a family. From a consideration of the histopathology, it appears likely that the basic factor involved

is obstruction of the smaller pancreatic ducts and subsequent dilatation of the acini. Possibly the pulmonary changes are explained by the fact that the lungs and the pancreas develop from a common precursor and, in the embryo, lie very close together. Their development begins almost simultaneously and it may well be that the developmental error which produces the constricted pancreatic ducts also produces constricted and inadequate bronchi and bronchioles. The severe vitamin A deficiency from which these babies suffer may also be a factor in the repeated pulmonary infections which are so characteristic, but it is debatable whether the vitamin A deficiency is a cause or a result of the primary pathologic process. Most observers believe it to be a complication rather than a true etiologic factor, and to represent the complete failure to metabolize the fat-soluble vitamin A which results from the child's inability to absorb fats. Farber (4) thinks that abnormally thick secretion causes intrinsic obstruction of the small ducts and of the acini, resulting in atrophy of the acinar structures with condensation of the connective-tissue framework and the growth of new fibrous tissue. He also found inspissation of secretions and dilatation of ducts in the glands of the trachea, the bronchi, the esophagus, and the duodenum. That these changes are of the same general character as those seen in the pancreas led him to believe that the disease is a generalized disorder involving many gland structures, but with its greatest effect in the pancreas.

A number of explanations are offered for the pulmonary involvement. Decreased resistance to infection as a result of malnutrition and vitamin A deficiency seems reasonable, and the deficiency state might

<sup>1</sup> Presented at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30-Dec. 5, 1947.

explain the metaplasia of the bronchial epithelium and the secondary infection. On the whole, the accumulated evidence seems to favor a congenital origin, with atrophy and cystic degeneration of the exocrine portion of the pancreas, and with an increase in the interstitial fibrous tissue proportionate to the degree of occlusion of the duct system.

Pathologic examination of the pancreas discloses few changes which are grossly recognizable. Some pathologists describe infiltration with fat and an increase of fibrous tissue between the lobes. Calcareous areas are sometimes present. As a rule, the larger pancreatic ducts are patent and no gross dilatation is found. On histologic examination there are found dilated small ducts and acini containing some coagulated secretion. Many fibroblasts are seen, there is atrophy of the acinar parenchyma and increase of the interacinar and interlobular connective tissue. The islands of Langerhans are usually said to be normal, although Baggenstoss (5) described slight, but definite, changes in these structures in twelve of fourteen cases studied, with cells loosely arranged in bands and with intercellular edema. Fatty degeneration of the liver is fairly common, but there is no reference to any obstruction of the ducts or acini. Examination of the lungs discloses suppurative bronchitis and bronchiectasis. The infecting organism is nearly always the staphylococcus. The bronchi contain mucopurulent exudates, commonly thick and tenacious. Small bronchopneumonic patches are scattered through the lungs, and local emphysema is common.

These lung changes, then, are the basis of the roentgen findings which should enable us to suspect the presence of pancreatic fibrocystic disease. The earliest changes are hilar, and represent the defense reaction of the lymphatic nodes in these areas. They are bilateral and rather uniform, with mottled linear densities extending outward, making a sort of aura about the cardiovascular shadow. Bronchopneumonic patches are seen,



Fig 1 Film of trunk showing markedly distended bowel in meconium ileus

and a honeycomb appearance at the lung bases frequently represents bronchiectasis. These latter changes may be present in any part of the lung. Their appearance is, of course, only suggestive, and bronchograms are essential for definite recognition of bronchiectasis. The thick tenacious mucopurulent exudates which fill many of the bronchioles may result in air-trapping with resulting localized areas of emphysema, or may completely obstruct the bronchioles with the production of local areas of atelectasis. The bronchopneumonic areas may be quite extensive and, indeed, bronchopneumonia is commonly the immediate cause of death of children suffering from fibrocystic disease.

These roentgen findings are not, in themselves, diagnostic of pancreatic fibrocystic disease and it is only in association with a history of repeated pulmonary infection that the condition may be suspected. If the radiologist is aware of the nature of fibrocystic disease, and will go to the trouble of eliciting a short history, he will frequently be able to furnish the clue which will enable the clinician to establish the diagnosis. The importance of so



Fig 2 Chest showing bronchopneumonia upper right and linear atelectasis

Fig 3 Chest with bronchopneumonia, segmented and patchy atelectasis and emphysema

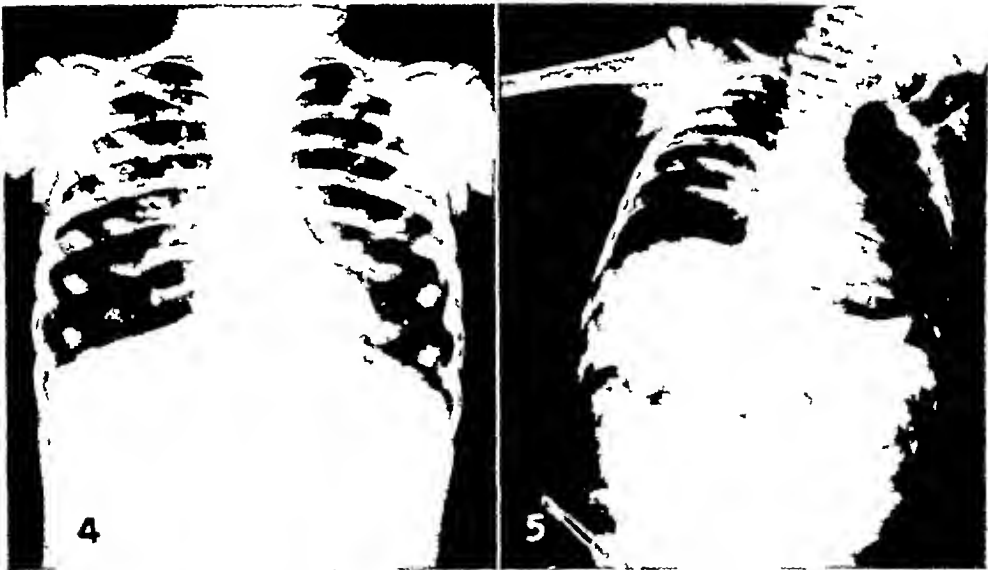


Fig 4 Chest showing hilar thickening, alveolar atelectasis and emphysematous blebs

Fig 5 Chest with bronchopneumonia and atelectasis

doing is indicated by the fact that, unless recognized fairly early, the disease will be fatal, while with an early diagnosis established and therapy instituted, some of these babies may be saved.

Children with this disease seem to fall into three groups

(1) Those who die in the first week or two with meconium ileus, intestinal stenosis, or atresia

(2) Those who, usually in their first year, display gastro-intestinal and respiratory tract findings, the presenting symptoms usually being those of pulmonary infection. They are generally believed to have recurrent "colds", they have a brassy cough, becoming spasmodic, they have repeated attacks of cyanosis and die of respiratory infection.

- (3) Those who present the signs and symptoms of celiac-like disease—*i e*, intolerance to carbohydrates and fats, failure to gain in weight or height, large, foul, light-colored foamy stools—associated with bronchitis and bronchiectasis

The symptoms and clinical findings are those of absence or gross deficiency of pan-

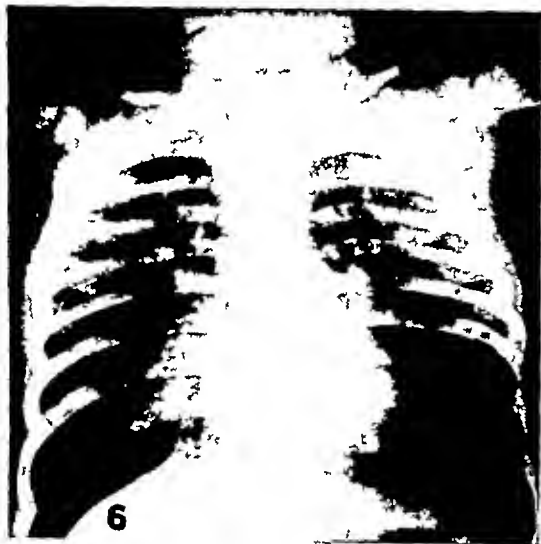


Fig 6 Chest showing bronchopneumonia, hilar thickening, and probable bronchiectasis

creatic secretion. Except for the first group, who present the signs of intestinal obstruction, the usual course is thus: the baby does well for a time, but begins to have diarrhea. It fails to gain or even loses weight, and repeated respiratory infections, ranging from bronchitis to bronchopneumonia, develop. The bulky, foul gray stools suggest celiac-like disease and this is supported by the abdominal distention. The findings on roentgen examination of the chest should suggest the possibility of pancreatic fibrocystic disease and thereafter the diagnosis may be thoroughly established.

Examination of the stool will reveal a very high fat content, frequently 60 to 70 per cent. Delayed glucose absorption from the stomach may be determined by the glucose tolerance test, if facilities are



Fig 7 Chest with bronchopneumonia, upper right

available, a vitamin A absorption test will reveal very poor absorption. The diagnosis may be made with accuracy by study of the duodenal secretion. Under fluoroscopic guidance, a Levine tube is passed into the duodenum and the secretion collected and assayed for the pancreatic enzymes. The absence of trypsin is the most significant finding, but there will commonly be decrease in amount, or absence, of lipase and amylase. This procedure, of course, is a severe ordeal for a baby already exhausted by the disease. Recently a new procedure, has been devised consisting in an amino-acid tolerance test, which may replace the duodenal content assay.

On physical examination, the baby is usually found to be emaciated in spite of a good appetite and an apparently adequate diet. Profuse moist râles are heard in the chest, the abdomen protrudes and the extremities are thin. Clubbing of the fingers and toes may be present, but is an infrequent finding.

From the standpoint of therapy, the disease must be attacked in two ways, namely the treatment of the respiratory tract infection and the establishment of an adequate diet for a child who has no pancreatic secretion. The pulmonary disease is combated, as is any other lung infection,

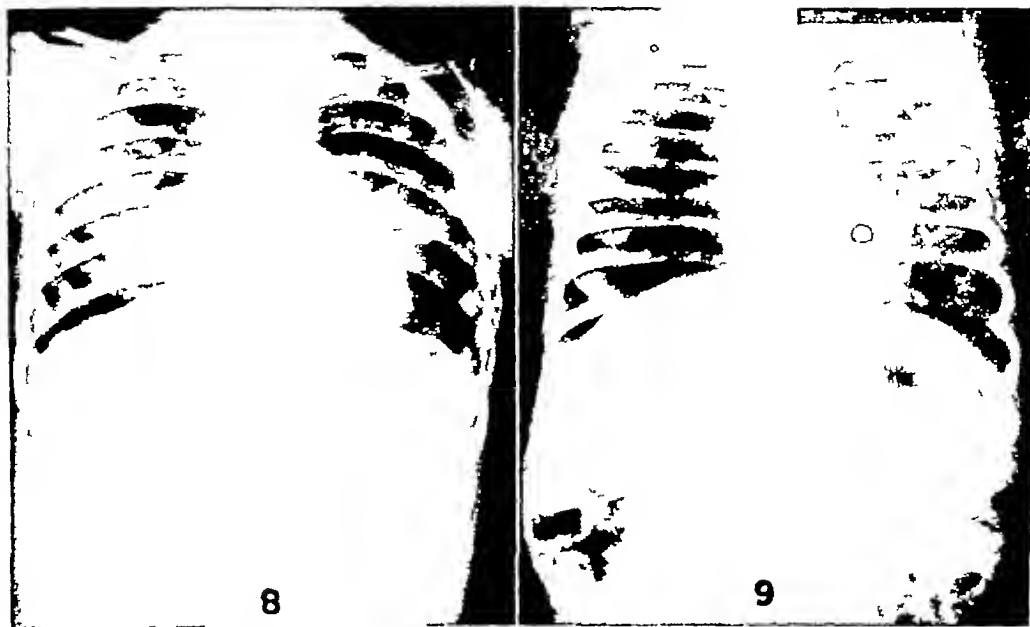


Fig 8 Chest showing bronchopneumonia hilar thickening, and atelectasis

Fig 9 Chest with hilar thickening and emphysema

with sulfonamides and with penicillin, particularly aerosol penicillin. The concomitant vitamin A deficiency requires the administration of very large amounts of vitamin A, frequently as much as 150,000 units per week supplemented with vitamins B, C, and D. Pancreatic extract is a logical form of substitution therapy, but very large amounts are required, and it is difficult for small children to swallow the enteric coated capsules which are necessary. Enteric coated granules of pancreatic extract are now available, and these may be offered in the baby's food. Milk, as a basic article of infant diet, can be replaced by the casein hydrolyzates, which require no pancreatic ferments for their digestion. Nutramigen, a casein hydrolyzate in amino acid form with dextrin, maltose, and olive oil, is a convenient substitute.

#### ILLUSTRATIVE CASES

**CASE I** A male infant, 10 weeks of age, was admitted with a history of fever, diarrhea, and cough for four days. He had had large soft stools since birth. He was a well developed child, very pale, coughing but not in any apparent distress. The abdomen was distended, but was neither tender nor rigid. There were no other findings, and the clinical

impression was "anemia, bronchitis, and diarrhea." The urine and blood were essentially normal on admission, but within twenty-four hours, the urine became bloody and a considerable amount of albumin appeared. On the same day an x-ray examination of the chest showed changes thought to be characteristic of pancreatic fibrocystic disease. Stool examinations showed over 60 per cent fats to be present. Appropriate therapy was instituted, and the child was discharged on the twelfth day. His present condition, at about two years of age, is fairly satisfactory.

**CASE II** A female, aged 6 months, has progressed through all three stages of the disease and serves well to illustrate them. On the first day of life, she began to vomit, and abdominal distention was noted. In spite of the fact that x-ray examination demonstrated a rather typical meconium ileus, nothing was done, and on the following day the distention had increased very markedly. On the third day, the child appeared moribund, and the abdomen was opened. Multiple aspirations of the small intestine were done with a fine needle, and the air was thus removed. The rectum was opened and much thick inspissated meconium was removed with a suction tube. Amigen therapy was instituted, and penicillin and streptomycin were given. Recovery was slow, but on the tenth day normal stools were observed and distention had disappeared. The stools gradually became very bulky and very foul, and on the thirteenth day, examination showed the presence of 50 per cent neutral fats and 11 per cent fatty acids. On the fifty-first day, lung changes consistent with pancreatic fibrocystic disease were noted. The child is now

six months old, and is doing fairly well under a regulated diet and therapy as described above

### CONCLUSIONS

(1) Fibrocystic disease of the pancreas is a not uncommon, but infrequently diagnosed, disease of infants

(2) Early diagnosis is essential if the child is to have any chance of survival

(3) The disease may be suspected by study of chest roentgenograms (4) It is, therefore, important that radiologists be aware of it and familiar with the concomitant lung changes so that they may suggest to the clinician the possibility of its existence

### REFERENCES

- 1 ANDERSEN, D H Cystic Fibrosis of the Pancreas and Its Relation to Celiac Disease, A Clinical and Pathological Study *Am J Dis Child* 56 344-399, 1938
  - 2 GARROD, A E, AND HURTLEY, W H Congenital Family Steatorrhoea *Quart J Med* 6 242 243, 1913
  - 3 PASSINI, F Pankreaserkrankung als Ursache des Nichtgedeihens von Kindern *Deutsche med Wchnschr* 45 851, 1919
  - 4 FARBER, SIDNEY Medical Progress, Pancreatic Insufficiency and the Celiac Syndrome *New England J Med* 229 653, 682, 1943
  - 5 BAGGENSTOSS A H, AND KENNEDY, R L J Fibrocystic Disease of the Pancreas Study of Fourteen Cases *Am J Clin Path* 15 64-70, 1945
- 1930 Wilshire Blvd  
Los Angeles 5, Calif

### SUMARIO

#### Enfermedad Fibroquística del Páncreas

La enfermedad fibroquística del páncreas es una afección congénita, familiar, muy letal, de las criaturas, acompañada regularmente de alteraciones pulmonares que revela la radiografía. Las más tempranas son hiliares, bilaterales y bastante uniformes, con sombras lineales moteadas que se extienden hacia afuera, formando una especie de aureola alrededor de la sombra cardiovascular. Se distinguen placas bronconeumónicas, y el aspecto apanalado en las bases pulmonares representa frecuentemente la bronquiectasia presente. Estas

últimas alteraciones pueden existir en cualquier parte del pulmón. Puede haber zonas localizadas de enfisema o atelectasia. Las zonas bronconeumónicas pueden ser bastante extensas y la muerte se debe habitualmente a bronconeumonía.

Aunque dichos hallazgos no son en sí mismos diagnósticos de pancreatopatía, pueden suministrar la clave que conduzca a la interpretación acertada de los hallazgos clínicos y el establecimiento exacto del diagnóstico por medio de pruebas apropiadas de laboratorio.

### DISCUSSION

(Papers by Bromer and Harvey, Neuhauser, Shwachman, Wittenborg and Cohen, Evans, Goin)

Albert Ferguson, M D (Brookline, Mass) I have enjoyed seeing the cases presented by Dr Bromer, and I believe that he has established his point. The fact, however, that in these cases the roentgen evidence of rickets is slight, though severe rickets is present, indicates that the diagnosis is actually established by other means—by the clinical pathology. Thus, the paper probably serves chiefly as a warning that we cannot eliminate rickets in the presence of the other conditions which are mentioned, especially scurvy and syphilis.

Dr Bromer, of course, remembers the extreme

clinical manifestations of both scurvy and rickets that we used to see many years ago. The cases that he designates as rickets of marked degree I believe are chemically of marked degree, but probably not so extreme as those which were seen before the vitamins were identified and used therapeutically. It is probable that there are many places, as Puerto Rico and Ethiopia, where the old conditions still remain. Doubtless if one were on service there, he would see many instances in which the roentgen changes of rickets had become quite marked even with associated scurvy.

I think that I rely a little more than Dr Bromer

does on the appearance of the transverse spurs in scurvy. They not only tend to stand out on a horizontal plane but also they tend to be less dense in the adjacent cortex, and to have a rounded end and a somewhat minutely irregular surface, whereas the lipping or saucerization in the rachitic changes seems to me to be smooth on the outer surface, to have some inclination distally, and to be more dense.

**Ralph S. Bromer, M.D.** It was not my intention to discredit the lateral spur as a sign of scurvy. It is a valuable sign of scurvy. Occasionally, in the presence of hemorrhage with swollen resting cartilage, the spur may not lie at a right angle to the shaft nor will it be definitely semicircular, in which case differentiation between cupping of rickets and the spur of scurvy may be difficult.

**Orvar Swenson, M.D. (Boston, Mass.)** I want to commend Dr. Evans on the presentation of an excellent paper. Many people in the medical profession take little interest in newborn babies with grave congenital lesions, simply because they consider the situation hopeless. To demonstrate that this attitude is incorrect, I will give you the results of the treatment of one group of these patients.

Up to eight years ago there were no successful operations for atresia of the esophagus. This was largely due to the fact that these patients were ten to fourteen days of age and had extensive pneumonia at the time of operation. The situation was, from a surgical standpoint, quite hopeless. During the past eight years the situation has changed. There is a renewed interest in the diagnosis of this condition and we have had the opportunity of operating on 36 of these infants, with only 6 postoperative deaths, in the past two years. This change is due largely to the fact that the diagnosis has been made promptly. These infants are brought to us now at two or three days of age, in good general condition, and operation is successful, in a large number of cases, in making these babies perfectly normal individuals.

I wanted to make a comment on Dr. Evans' mention of the treatment of intussusception, though I have to be very careful of what I say, as I see no surgeons in the audience who could rescue me. I do not believe that Dr. Evans and I differ a great deal on the actual care of a given patient, our difference concerns how this problem should be written about and what our teaching to students should be.

Fortunately, little has appeared in American medical literature advocating reduction of intussusception by use of the barium enema. To teach this form of therapy would be to undo a great deal of progress which has been made in the care of infants with this disease. I do not mean to imply by

these comments that reduction of an intussusception is never accomplished in our hospital by the administration of a barium enema. The way the situation actually works out is quite satisfactory. Patients sent to Dr. Neuhauser for a diagnostic barium enema are patients in whom the history, while suggestive of intussusception, is atypical and a palpable mass is not present, and therefore a clinical diagnosis cannot be made. During the course of a diagnostic barium enema study, an early intussusception may be reduced, and this is quite satisfactory.

On the other hand, patients with a typical history, including rectal bleeding and a palpable abdominal mass, should not be sent to the x-ray department. Attempted reduction by barium enema under these circumstances consumes valuable time which could be more profitably spent in preparing the patient for operation. Furthermore, reduction may be incomplete, and ten to fourteen hours may go by before this failure is recognized by the clinical course. This delay may convert the intussusception into one that requires resection, which carries a formidable mortality.

I firmly believe that administration of a barium enema in patients with suspected intussusception should be a diagnostic procedure and not a frank form of therapy. I actually think that, in the care of the patient, that is what Dr. Evans also believes.

**Albert Ferguson, M.D.** Dr. Neuhauser and his associates have been fortunate in encountering these two or three cases of what is obviously a rare disease and they are to be congratulated upon being sufficiently alert to have followed them and studied them so closely. To me they are exceedingly interesting cases which raise a number of problems in bone physiology and reaction of bone to various factors.

The lengthening of the bones was not emphasized, but probably most of you noticed that the abnormal length of the bones was quite remarkable. The cortical changes certainly suggest Paget's disease, but there are definite differences from Paget's disease aside from the age of occurrence, for example, the sparing of the area of bone about the arterial foramen, the rapidity of spread of the lesion in the bone, the symmetrical distribution, and the lengthening of the bones, which is much greater than the lengthening occurring in Paget's disease.

Medullary changes I think are quite distinct, indeed unique. The texture of what appears to be the internal structure of the bone is quite different from the texture in Paget's disease or any other lesion which I have seen. It is a very irregular, poorly formed, poorly expressed texture. If I had to liken it to something, I should say that it suggests the appearance of a piece of worn, loosely woven burlap.

The etiology, of course, is something which you will all speculate about, and it is quite possible to practically run the gamut of conditions which may influence bone as possible etiological factors in this condition

First, as to an endocrine factor the patients did not show any evidence of known endocrine disturbance which would account for the lesions, so that, if they are to be explained on this basis, some previously unknown endocrine disorder will have to be proved. The same thing can be said about avitaminosis. This is not one of the ordinary vitamin deficiency diseases, though there may be some unusual vitamin that should be considered. A possibility that must be given consideration nowadays is that some of the pathological organisms producing disease may be altered by radiation, so that new diseases may be observed, previously unknown because the organism did not exist. This raises the possibility of an unknown virus infection or some previous inflammation, with residual bony changes.

There exists also the possibility of a myelitic element—an improper development of the nervous system in relation to the mesodermal structures, with some neurotrophic disturbances affecting the latter, especially the periosteum. You noticed the atrophy of the soft tissues and the presence of nevi in the skin of one of the patients. Diseases which might affect the vessels, similar to typhus or possibly syphilis—though neither of these diseases was present in the cases reported—might conceivably cause this nutritional disturbance.

The mechanism through which the etiological factors act seems to be one in which the periosteum is much thickened and the nutrition of the bone altered and affected in the areas where growth is the fastest. In the femur, for example, the lower portion, which grows faster, was much more affected than the upper portion, and the general distribution is related to rapidity of growth.

On the whole, this is a very interesting group of cases, presenting all sorts of possibilities—a very rare condition probably, but if you all look for it, you doubtless will hear more of it.

Edward B. D. Neuhauser, M.D. (Boston, Mass.) Dr. Goin has intimated, I think, that the clinicians and radiologists continue to overlook fibrocystic disease of the pancreas with unusual persistence. I am not sure that that is true in New England. In the last few years we have given it all the emphasis we can. Certainly any disease which contributes 4 per cent of the autopsies of any children's hospital, or any hospital dealing largely with children, is of considerable

importance. It is an old truism that if you don't think of a disease you are not going to diagnose it, so I am very happy to give it what emphasis I can.

I think in the diagnosis of the changes associated with cystic fibrosis of the pancreas as exemplified in the lungs, one must go back to the healthy newborn child. As you see the chest film of a healthy infant under the age of two or three weeks, there is a considerable degree of irregularity of aeration. You may normally see emphysema at the base, peripheral emphysema, and bulging of the interspaces, and you may well see small plate-like patches of atelectasis, but as soon as the child grows beyond the neonatal period, such a picture is not normal. The chest of a child over three or four weeks of age that shows emphysema, focal or plate-like atelectasis or lobular atelectasis, is definitely abnormal, and one of the diseases that will most frequently produce that particular abnormality is fibrocystic disease of the pancreas.

From then on, the changes that Dr. Goin has described to you are obvious. The more advanced the lesion the more easily may the diagnosis be made, so that eventually, in the late stage, in a child with chronic respiratory symptoms, there is a possibility of making the correct diagnosis, certainly in over 90 per cent of the cases, from the chest film, in association with the history and clinical findings. As Dr. Goin said, occasionally the respiratory symptoms completely outweigh any symptoms referable to the gastro intestinal tract so that one may not suspect the true diagnosis. But we must suspect this disease always. It has now become a very common procedure—at least in the past few years—to intubate any baby or any young child who shows anything that may in any way suggest this pancreatic fibrosis.

Fortunately there are going to be methods of making the diagnosis which are more easily performed, such as the amino acid tolerance test. Some of the examinations are rather difficult, for example, analysis of duodenal enzymes for tryptic activity, on which the diagnosis is based. But here one can go right back to radiology. Take an unexposed film with its emulsion on, take the duodenal enzyme—you can dilute it up to one to ten to one to a hundred—and put little drops of it on the film. If there is a sufficient amount of trypsin present, the emulsion of the film will be digested and you will get a little clear spot, so you can make the diagnosis right in your own office.

I think Dr. Goin is to be congratulated on a very lucid and exhaustive paper. I have very little to add, but I would like to place emphasis on just this. Think of the condition, and you will see dozens of cases.

# The Roentgen Appearance of the Chest in Diseases Affecting the Peripheral Vascular System of the Lungs<sup>1</sup>

## I Conditions Associated with Increased Vascular Permeability<sup>2</sup>

ROBERT P. BARDEN, M.D., and DAVID A. COOPER, M.D.

THE INCREASED knowledge of pulmonary physiology gained through research stimulated by the war, and the extraordinary advance in thoracic surgery in the past few years, have made necessary a critical review of ideas concerning pulmonary pathology as revealed in roentgenograms of the chest. In any such re-evaluation, it becomes apparent that there is a scarcity of information relative to diseases of the peripheral vascular system of the lungs, particularly in the radiologic literature.

From the standpoint of pathologic classification (1) the small blood vessels of the lung may be affected by disease in a manner which results in increased permeability of their walls, which may or may not be associated with actual anatomical defects, or in acute or progressive obstruction of their lumina leading to a marked reduction in the pulmonary vascular bed (Table I). This paper deals with the first of these two alternatives.

### ETIOLOGY AND PATHOLOGY

#### *General Considerations*

Some of the factors associated with damage of the walls of the peripheral vascular system of the lungs may now be considered. It has long been known that the force of a blow may be transmitted through the intact chest wall and produce damage to pulmonary blood vessels, resulting in an outpouring of serum, plasma, or whole blood into the pulmonary tissues. If the trauma is the result of a direct blow, the process in the lungs is localized to a

TABLE I. PATHOLOGICAL CLASSIFICATION OF DISEASES OF PULMONARY ARTERIOLES AND CAPILLARIES (*After Brenner*)

- 1 Sclerosis
- 2 Endothelial proliferation
- 3 Infections, acute and chronic
- 4 Neoplasm
- 5 Thrombosis
- 6 Allergy
- 7 Increased permeability

segment or lobe, but the entire substance of both lungs may be affected by the pressure wave of a high explosive blast, without any injury occurring to the thoracic cage. There are two ways in which extravasation of blood elements may be brought about. The direct result of the force applied to the vessel walls may produce changes in tone of capillaries and arterioles, with dilatation and increased permeability, first to fluid, and later to cellular elements, or there may be actual rupture of the vessel wall. On the other hand, the blow may be followed by prolonged arteriolar spasm which markedly decreases the available vascular bed, increases pressure in the pulmonary circuit, and may result in failure of the right ventricle and diffuse pulmonary edema (2).

Another possible factor involved in altered function of capillary walls is the presence of a nutritional deficiency state. It has been shown that chronic hypoproteinemia results in latent or obvious anasarca (3) in which pulmonary capillaries may well participate (4). Again, the extent and degree of edema associated with beriberi are often not explained on the basis of cardiac failure alone and Weiss (5) has described the disease as affecting the circulatory system as a whole. There may

<sup>1</sup> From the Department of Radiology and the Department of Medicine of the Hospital of the University of Pennsylvania.

<sup>2</sup> Part of the material in this paper was presented as an exhibit at the Thirty second Annual Meeting of the Radiological Society of North America in Chicago December 2-6, 1946, and received the second award for merit. Accepted for publication in September 1947.

be episodes of sudden occurrence of a shock-like state which indicates that peripheral vessels, particularly capillaries, may be involved. Further, Waldenstrom (6) has recently called attention to a rare and heretofore unrecognized condition to which he has applied the name of relapsing diffuse pulmonary bleeding or hemosiderosis pulmonum. This is thought to be due to a disturbance in iron metabolism, and results in repeated focal hemorrhages throughout the lungs, without evident cause.

In the field of pathologic physiology, a great deal of information has been accumulated which concerns the reaction of the smooth muscle in the walls of pulmonary arterioles when exposed to drugs and antigenic substances. Gilbert (7) made microscopic studies of isolated cross sections of pulmonary arteries after the administration of various drugs and antigens. He concluded, on the basis of the prolonged contraction which he was able to produce, that the cause of anaphylactic death in rabbits is spasm of the pulmonary blood vessels. This spasm could not be relieved by adrenalin or benzedrine but was partly overcome by atropine.

During the past fifteen years, other investigators in the field of allergy and pulmonary pathology have become increasingly aware of the role of the peripheral vascular system as a common denominator in many diseases formerly considered as distinct clinical entities (8). In 1942, Rich and Gregory (9) undertook a series of animal experiments which have continued to the present and have resulted in evidence of fundamental importance in relating hypersensitivity states to widespread pathologic changes in peripheral vessels. These investigators sensitized rabbits to horse serum and subsequently injected minute amounts of the antigen, producing lesions throughout the animal which were identical with the pathological lesions in patients dying with serum sickness, sulfadiazine poisoning, acute rheumatic fever, and periarteritis nodosa. The essential features of these lesions both in animal and man were widespread areas of

TABLE II CLINICAL STATES ASSOCIATED WITH INCREASED VASCULAR PERMEABILITY AND REFLECTED IN ROENTGENOGRAMS OF THE CHEST

- 1 Trauma  
Blast  
Direct blow or crushing injury
- 2 Allergy  
Asthma  
'Loeffler's syndrome'  
Sensitization to parasites
- 3 Poisoning  
Inhalation of irritating gases  
Systemic arsphenamine and other exfoliative dermatitis
- 4 Acute glomerular nephritis
- 5 Acute rheumatic fever
- 6 Lupus erythematosus
- 7 Acute and chronic periarteritis nodosa
- 8 Epidemic influenza
- 9 Beri-beri
- 10 'Relapsing diffuse pulmonary bleeding' (Waldenstrom)
- 11 Eclampsia

focal necrosis in small arterioles and capillaries accompanied by a perivascular inflammatory reaction which may go on to healing with more or less characteristic scar tissue. The concept that allergy may be an important factor in many different clinical entities, has also been advanced by Harkavy (10, 11), who believes that the small blood vessels may act as shock organs in such conditions as serum sickness, drug poisoning, some forms of asthma, and periarteritis nodosa. He has suggested that recurrent episodes of vascular allergy in the lungs may be one cause for the frequent finding of pulmonary arteriolar sclerosis at autopsy and may thus play a role in the production of pulmonary hypertension, in the same way that allergy has been implicated in some instances of systemic hypertension (12).

Although the fundamental pathological lesion in small blood vessels is similar in a great variety of clinical conditions (Table II), it may be produced by many different agents, so that similarity in microscopic pathology and in the roentgen appearance of diseased lungs does not indicate a common etiology. Conversely, it is quite likely, as Grant (12) and Rich (13) both have pointed out, that the same disease agent may affect different individuals in a dissimilar manner, with, for example, involvement of lungs in one case and kidney in another, and result in such dissimilar

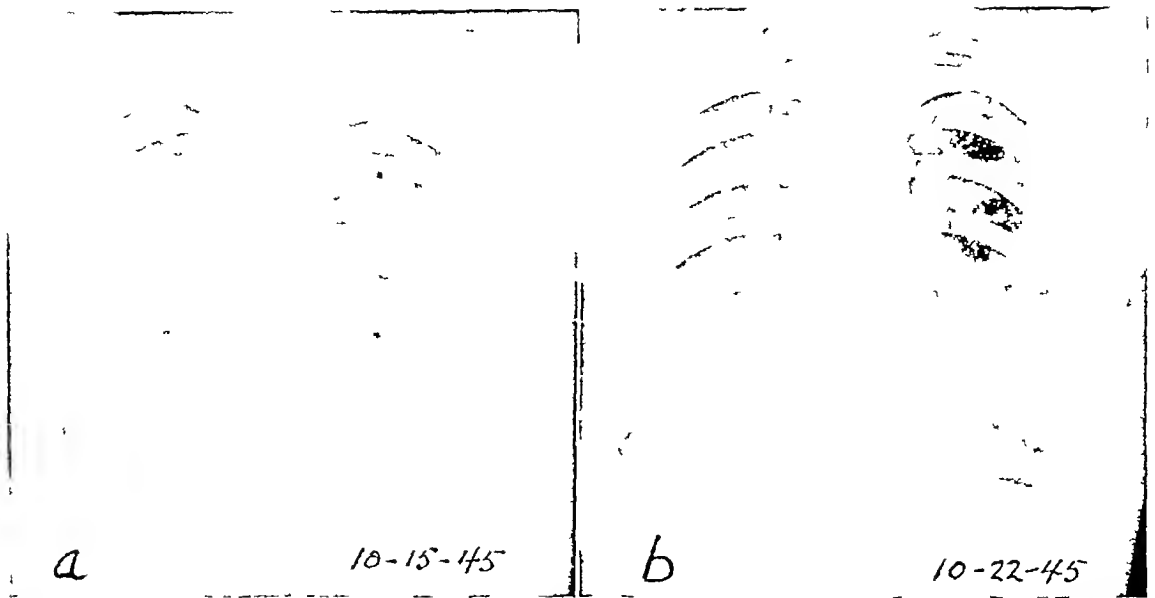


Figure 1

*History* Crushing injury to chest with subsequent cough, bloody sputum, and dyspnea. Recovery.

*Findings* Examination forty-eight hours after injury showed a homogeneous shadow covering part of the right upper lobe. No ribs were fractured. One week later the lung fields appeared normal except for a small amount of fluid at the right base.

*Diagnosis* Hematoma and hemorrhage of lung and pleura.

*Comment* The pulmonary findings in hemorrhage may be confused with those of pneumonia, unless the clinical history is available, and this could lead to a serious error in management. Furthermore, one may expect a delay of twenty-four to forty-eight hours between injury and the appearance of roentgen changes. This suggests that part of the process is a localized shock-like response in which increased capillary permeability plays an important role.

clinical states as asthma and glomerulonephritis. However, in the majority of these disease conditions with a fatal outcome, the peripheral blood vessels are involved throughout the entire organism, so that it is possible to consider the changes in one organ, such as the lungs, as reflecting the entire pathological picture. From this standpoint, therefore, one can understand the importance of interpreting correctly the changes which may be seen in roentgenograms of the lungs in patients with peripheral vascular damage. It is not too much to say that the roentgenogram of the chest may provide a window through which to view the condition of the peripheral vascular system as a whole, in a way analogous to the cornea of the eye, which looks in upon the retinal vessels (14).

#### *Clinical and Radiologic Considerations*

*Trauma* Experience in the late war has shown the frequency with which non-penetrating injuries of the chest have been

followed by pulmonary complications. Roentgenograms of the chest in these cases will frequently show shadows ranging from a localized dense lobar consolidation to a patchy lobular density, usually with pleural involvement and commonly accompanied by hemoptysis. These shadows are characteristically evanescent in nature when due to edema or hemorrhage, and their rapid disappearance in follow-up examinations serves to differentiate them from the changes due to infection. The difficulty in differential diagnosis which may be encountered at the time of the initial roentgen examination may be partly resolved by careful attention to the clinical history. Since pulmonary trauma differs so, in its management and prognosis, from the inflammatory pneumonias, the correct interpretation of roentgenographic findings may be of the utmost importance (Figs 1 and 2).

*Epidemic Influenza* The rarity of epidemic influenza in recent years does not

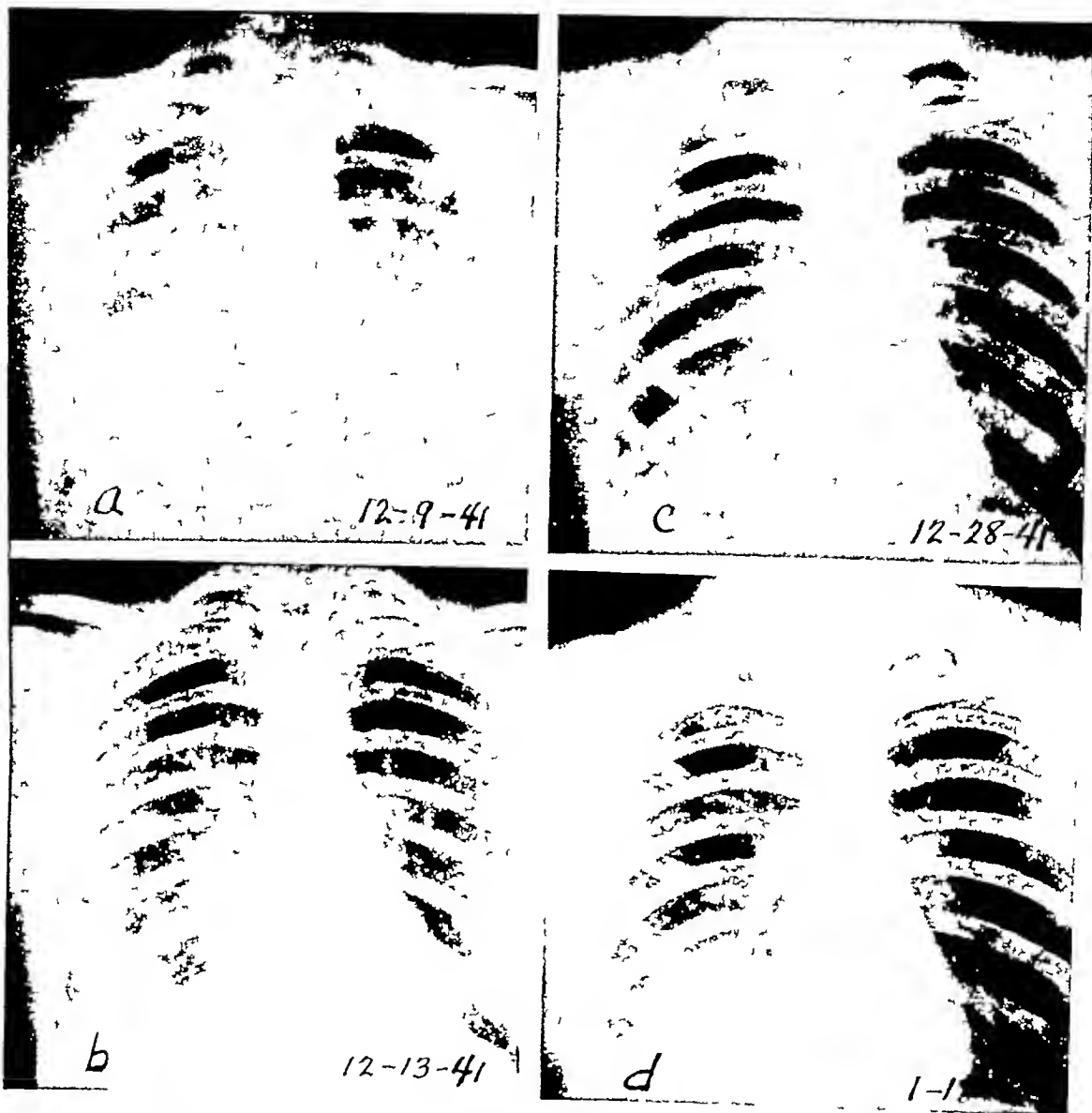


Figure 2

**History** Naval officer bombed during attack on Pearl Harbor. No external injuries. Dyspnea and cough with bloody sputum lasting four days. Onset of pain right lower chest, three weeks later. Eventual recovery.

**Findings** Two days after bombing portable examination showed diffuse clouding of both lungs, with patchy shadows, interpreted as areas of edema and hemorrhage. Four days later many of the shadows had disappeared, and three weeks later lung fields were normal except for alteration in the curve of the right diaphragm. At this time, pain had developed in the right lower chest. Roentgenogram six weeks after bombing showed a large isolated shadow in the right lower lung field, considered as representing an infarct.

**Diagnosis** Blast injury to lung with late development of infarct.

**Comment** It has been shown that the force of a blow can be transmitted through the intact chest wall and injure the lung. This results in exudation of fluid and cells from small blood vessels, just as occurs in a hematoma. The late complication of infarction in this patient was probably a result of slowly progressive thrombosis of a large vessel damaged at the time of the original injury.

detract from its peculiar importance in any consideration of diseases affecting peripheral pulmonary vessels. In its pathology, this condition is a classic example of an infectious agent acting directly upon the

capillaries of the lungs without producing demonstrable anatomic change in the vessel itself. In epidemic form, influenza causes death in a few hours to a few days as a result of a rapidly spreading hemorrhagic



Figure 3

*History* Sore throat abdominal pain, fever  $104^{\circ}$  for two days Patient hospitalized because of mental confusion progressing to stupor Temperature reached  $108^{\circ}$  Slight hemoptysis, minimal cough W B C 1,400 Increasing cyanosis and dyspnea with respiratory death three days later

*Findings* Portable examination on admission showed varying sized "cottony" shadows in periphery of lungs, coalescent at left base Two days later the process had spread to obscure most of the lung fields

*Diagnosis* Hemorrhagic pneumonia with secondary abscesses (epidemic influenza)

*Comment* This is the classical picture of epidemic influenza in which death occurs quickly because of massive edema and hemorrhage from pulmonary capillaries and arterioles The cause of the increased vascular permeability is thought to be some toxin formed by H influenzae

pneumonia Blood leaks from intact vessels in the alveolar septa due to a marked increase in the permeability of the vessel walls The protein elements of plasma may be identified as a pink hyaline membrane adjacent to the capillaries if the disease runs a more protracted course The patients exhibit signs and symptoms of rapidly progressive pulmonary failure which may seem out of proportion to the roentgen changes in the chest If, however, serial roentgenograms are obtained at intervals of six to twelve hours after onset of the disease, one sees an increasing haze envelop the lungs from the periphery toward the hila, becoming denser and confluent from hour to hour until no aerated lung remains visible (15) (Fig 3)

*Disseminated Lupus Erythematosus* Although the clinical picture of disseminated lupus erythematosus is that of a polyserositis, the fundamental pathologic process involves much more than serosal surfaces The essential lesion is a fibrinoid degenera-

tion of collagen throughout the body, associated with a necrotizing arteritis involving arterioles, particularly in the kidney and heart, but also in many other organs including the lungs This is reflected in the acute and rapidly progressive symptoms and signs of dermatitis, renal failure, psychosis, cardiac and pulmonary failure The character and progression of the shadows in roentgenograms of the chest may be indistinguishable from the picture of epidemic influenza (Fig 4) Of additional interest is the knowledge that this clinical state of disseminated lupus is one of a large group of diseases having a common pathologic denominator but exhibiting individual clinical variations depending on the organ most severely involved (16)

*Acute Rheumatic Fever* There is general agreement among pathologists that acute rheumatic fever is a collagenous degeneration and polyarteritis (17, 18) which selectively localizes in the heart but may also be

found in many other organs, as witness the arthritic, serosal, intestinal, and pulmonary variations of the disease. In the acute fulminating form of rheumatic fever in young adults, pulmonary complications are found in as high as 50 per cent of patients (19). It has been stated by Klempner (20) and others (21) that the pulmonary lesions associated with rheumatic fever are peculiar and differ from the ordinary bronchopneumonias. Although typical Aschoff bodies are not found in the lung, there may be multiple areas of perivascular exudation involving peripheral vessels which may heal and form a perivascular nodule of connective tissue. It would seem, therefore, that the term "rheumatic pneumonitis" is a valid and useful one and can be applied to describe the pathologic changes occurring in peripheral pulmonary vessels and reflected in roentgenograms of the chest in many patients with acute rheumatic fever. The roentgen appearance is that of a diffuse haze involving the middle and upper portions of the lung fields in a rather symmetrical manner, with the maximal density in the middle and outer pulmonic zones. This appearance often occurs without evidence of heart failure and is not associated with enlargement of the hilar shadows (Fig 5). If heart failure and pulmonary congestion are present, the characteristic shadow pattern of rheumatic pneumonitis is obscured by the picture of general vascular congestion and, therefore, may often be unrecognized.

**Exfoliative Dermatitis** It is well known that exfoliative dermatitis is caused by many toxic agents and is non-specific in its pathologic manifestations. Patients developing a sensitivity to arsphenamine present the typical clinical picture. A diffuse erythema involving the skin over most of the body is followed by scaling, desquamation, itching, induration of the subcutaneous tissues, and alopecia. The condition runs a protracted course of many weeks, characterized by remissions and exacerbations. It is ushered in by a high fever and prostration which afford sufficient evidence that it is a systemic disease.

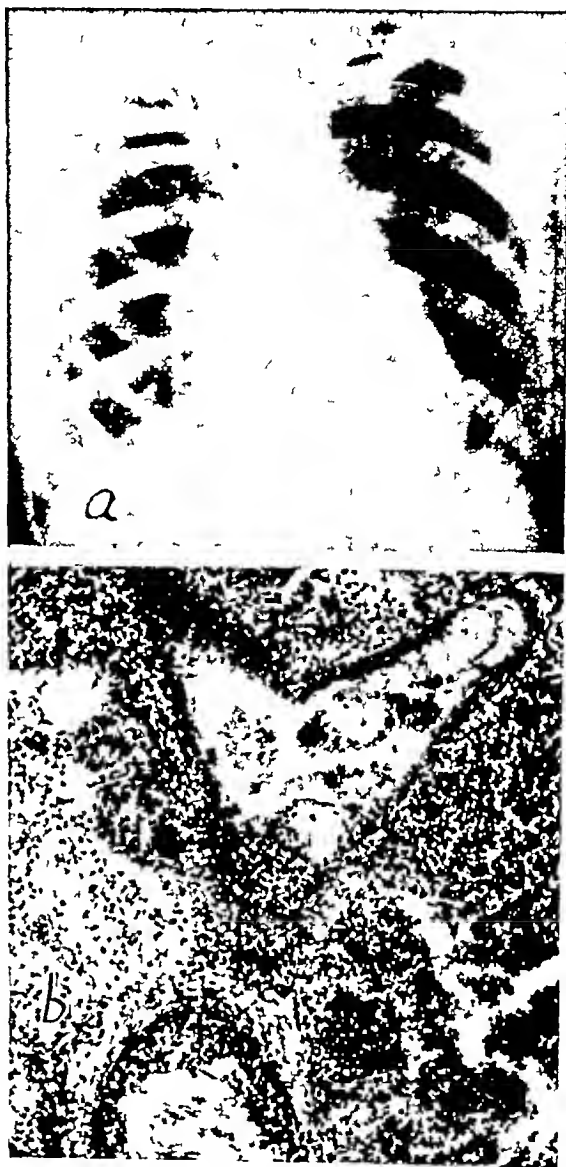


Figure 4

**History** Acute illness of one week's duration, with swelling of eyelids, butterfly rash on face and severe joint pains. Temperature 104°. RBC and albumin in urine. Blood urea nitrogen 55. Secondary anemia. Cough, dyspnea, hemoptysis, hoarseness, psychosis. Death one week after admission.

**Findings** Coalescent "fluffy" shadows in the periphery of upper lung fields resembling those in Fig 3 and undoubtedly due to exudation and hemorrhage following damage to walls of peripheral arterioles and capillaries. (Compare with photomicrograph.)

**Diagnosis** Acute lupus erythematosus

**Pathology** Lung tissue  $\times 250$ . A medium sized vessel is shown with acute arteritis involving all the coats of its wall. There is a surrounding bronchopneumonia.

**Comment** Although the etiology is unknown, acute lupus erythematosus is associated with an arteritis of small vessels pathologically similar to influenza and rheumatic fever.

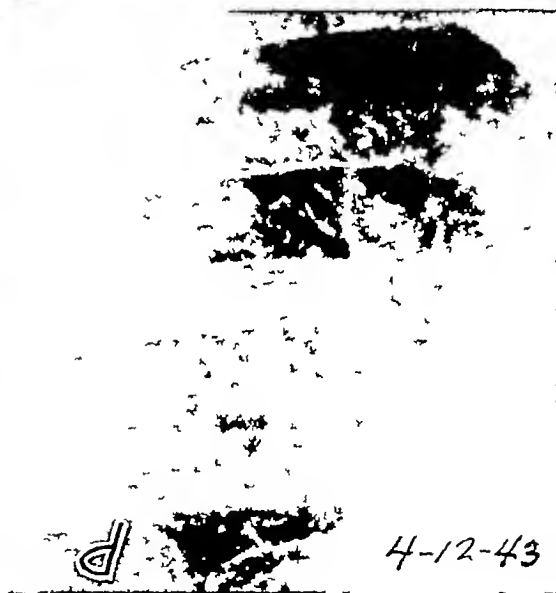
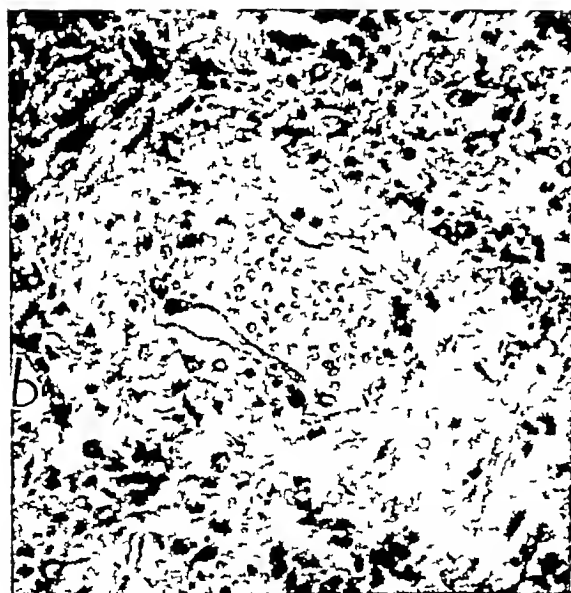
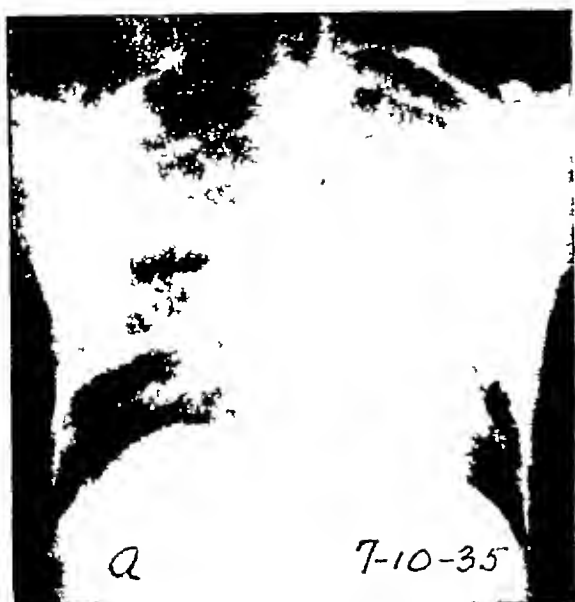


Figure 5

*History* Known rheumatic heart disease with acute exacerbation with sore throat, fever, rash, and abdominal pain. Patient living and well ten years later.

*Findings* At height of illness, a portable film showed a diffuse hazy shadow obscuring upper half of each lung. Note 'fluffy' character typical of vascular lesions, without evidence of cardiac failure. After recovery, follow up roentgenograms have revealed an unchanging pattern of diffuse, symmetrical nodulation, probably representing organization of areas of perivascular exudation, possibly with deposition of hemosiderin. (Compare with photo micrograph of similar case.)

*Diagnosis* Acute rheumatic fever

*Pathology* A section of the pulmonary artery of a seventeen-year-old patient with chronic rheumatic cardiovascular disease who died during an attack of acute rheumatic fever. The wall of the artery shows marked necrosis and an adventitial and periarterial inflammatory reaction is evident.

*Comment* This is a good example of the controversial 'rheumatic pneumonia'. The acute lesion of rheumatic fever is a periarteritis, occurring in the lung as elsewhere. Healing may result in perivascular nodulation.



Figure 6

*History* Onset of fever  $104^{\circ}$  and spreading rash following four injections of neoarsphenamine for syphilis. Acute dyspnea, cough and cyanosis requiring oxygen. Eventual recovery.

*Findings* On admission, the hilar shadows were enlarged and inner zone lung markings exaggerated. Roentgenogram four days later, during attack of dyspnea, showed a diffuse haze over both lung fields due to edema.

*Diagnosis* Exfoliative dermatitis (arsphenamine).

*Comment* The lung changes probably resulted from damage to small pulmonary vessels, analogous to changes in similar vessels in the skin and elsewhere.

It is not so widely known, however, that in exfoliative dermatitis, pathologic changes may occur in other organs beside the skin. Many of these patients show evidence of renal damage, and pulmonary symptoms are common during the acute phase of the illness. Roentgenograms of the chest may reveal a diffuse "inflammatory" process, disappearing rapidly within a few days and reappearing when the patient's general condition indicates exacerbation of the disease process. The evanescent nature of the pulmonary shadows and the uniform diffuse, symmetrical character suggest a focal perivascular origin (Fig 6). Since the toxic manifestations of exfoliative dermatitis occur primarily in the small blood vessels of the skin and kidney, it appears probable that similar focal vascular lesions account for the changes in the lungs (22).

*Acute Glomerulonephritis* In acute glomerulonephritis, as in the conditions previously discussed, vascular changes are not limited to one organ. Although occurrence of visible anasarca is variable, respiratory

and cardiac symptoms and signs are common. If one postulates increased arterial pressure or increased permeability of arteriole and capillary walls, or both, as the cause of peripheral subcutaneous edema, a similar explanation may be offered for the transient pleural effusions and pulmonary changes which will frequently be found if chest roentgenograms are obtained in these cases (Fig 7). In the presence of cardiac enlargement, the shadows in the lungs which are due to increased permeability of the peripheral vessels may be difficult to differentiate from passive congestion. However, some of these patients with cardiac enlargement may not show any clinical evidence of heart failure, in which case passive congestion cannot be responsible for any abnormalities seen on the roentgenogram (23).

*Periarteritis Nodosa* Periarteritis nodosa is a disease syndrome with specific pathological findings and protean clinical manifestations. The histologic lesion is a focal arteritis, and it may involve vessels in every organ of the body. Inflammatory

cells form a cuff about the small arteries and there is destruction of the vessel wall. The process may go on to healing, with hyaline degeneration and formation of a connective-tissue nodule and obliteration of the vascular lumen which mimics the changes in hypertensive vascular disease. A biopsy specimen from skeletal muscle will show the characteristic lesion. Among the clinical symptoms and signs, the commonest are asthma, peripheral neuritis or



Figure 7

*History.* Previous history not available. Death in army hospital with terminal hypertension and marked elevation of blood urea nitrogen and creatinine. Post-mortem examination.

*Findings.* Roentgenogram two days before death showed symmetrical 'fluffy' shadows extending out from each hilum to involve the inner half of each lung. These were interpreted as evidence of perivascular edema and appear identical with the findings in other hypersensitivity states such as periarteritis nodosa.

*Diagnosis.* Chronic nephritis terminal.

*Comment.* This is probably an example of the so-called "uremic" pneumonia which is a common clinical finding in terminal nephritis. The correct interpretation of widespread disturbance in the physiology of peripheral blood vessels may be suggested by the changes in the chest roentgenograms.

myositis, an elevated basal metabolic rate, and eosinophilia (24). The disease may be acute, subacute and remittent, or chronic over a period of many years. It may co-exist with or be indistinguishable from rheumatic fever, acute nephritis, asthma, dermatitis (exfoliative dermatitis and scleroderma) (25), sulfa drug reactions, and malignant hypertension (8, 12). It occurs



Figure 8

*History.* No significant previous illness. Sore throat, fever, spreading erythematous rash, abdominal pain and tenderness. Exploratory laparotomy revealed normal appendix, but serosanguineous peritoneal fluid. Postoperative course marked by attack of acute dyspnea and cyanosis controlled by oxygen and aminophyllin. Prompt recovery.

*Findings.* During attack of dyspnea and cyanosis, the hila and inner half of each lung field were obscured by soft 'cumulus' shadows. The evanescent nature of these findings indicated that they were not representative of ordinary consolidation. Cardiac enlargement was not present.

*Diagnosis.* Acute allergic state, etiology unknown (lupus erythematosus, rheumatic fever, periarteritis nodosa?).

*Comment.* The clinical and roentgenographic findings are very similar to those in the case of rheumatic fever previously described except for the lack of cardiac signs. This picture is not rare in late childhood and adolescence and may be recognized if the possibility of acute vascular disease is kept in mind. Of especial interest is the fact that the mother died of eclamptic convulsions following birth of this patient. This suggests a familial or transmitted tendency to acute vascular collapse.

in animals (pig, calf, dog, deer) in epidemic form, and may be epidemic in man (12).

It is generally believed that the small pulmonary vessels are less frequently involved (30 per cent of cases) in periarteritis nodosa than vessels in other organs, but it is probable that a higher percentage of pulmonary lesions would be found if they were more carefully sought. In any event most, if not all, patients with this disease will show pulmonary changes roentgenographically at some time during their illness (26). In the acute form of the disease,

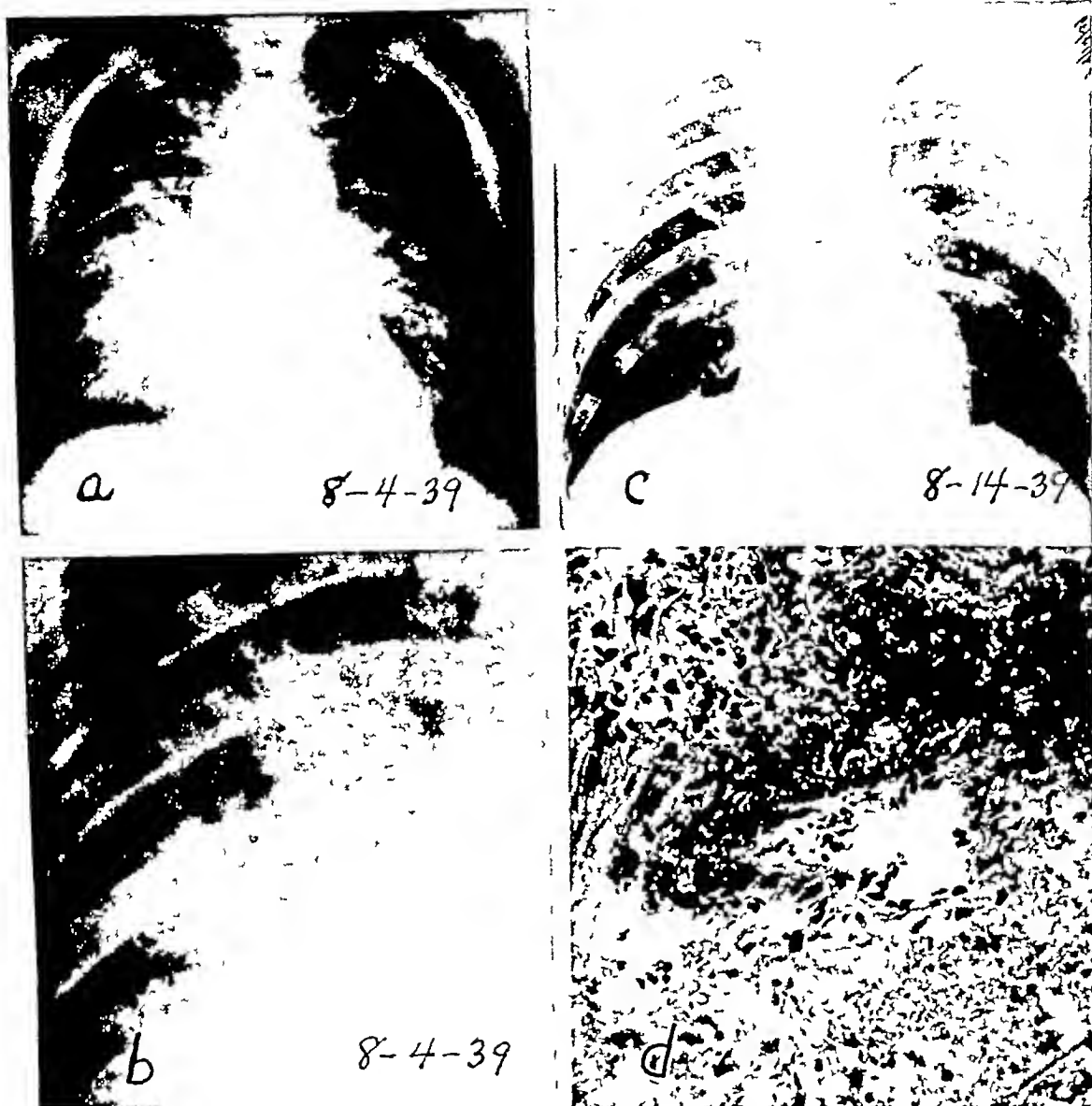


Figure 9

**History** Hospitalization because of loss of 30 pounds in six months and severe pains in all extremities, accompanied by "asthmatic" attacks and asthenia. Patient found to have B M R +50 and calcified gallstones. Provisional diagnosis, hyperthyroidism and peripheral neuritis due to avitaminosis. Several attacks of sudden respiratory embarrassment with cyanosis, requiring oxygen, in one of which death ensued.

**Findings** Admission roentgenogram, 7/15/39 showed nothing abnormal. During attack of extreme respiratory distress, 8/4/39 extensive changes occurred in the inner two thirds of each lung field compatible with increased capillary permeability and edema. Symptoms ceased abruptly after forty eight hours, and follow up roentgenogram, 8/14/39 showed remarkable clearing of the shadows. Note that there is no evidence of cardiac failure.

**Diagnosis** *Periarteritis nodosa*

**Pathology** Heart tissue, X300. Several medium sized vessels are shown with fibrinoid necrosis of their walls and leukocytic infiltration of both vessel walls and surrounding tissue. This is the characteristic lesion of *periarteritis nodosa*.

**Comment** The pulmonary manifestations of *periarteritis nodosa* are mentioned infrequently. These patients all have a long history of 'asthmatic' attacks which are probably transient episodes of pulmonary edema, progressively severe, ending in respiratory failure. It is not widely realized that subacute or chronic states resembling *periarteritis nodosa* may be common in epidemic form.

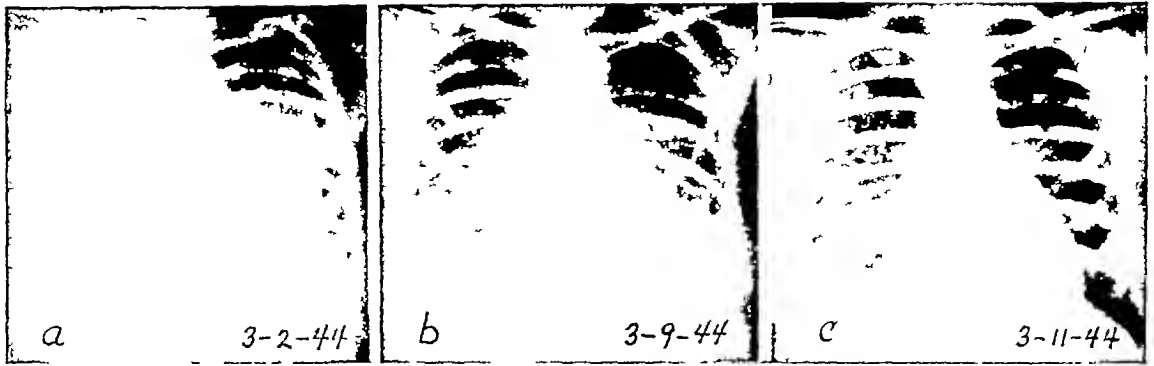


Figure 10

**History** Pneumococcus pneumonia developing following normal delivery. Toxicity indicated by rapidly increasing anemia. Recovery with penicillin. Two weeks later patient became acutely dyspneic and cyanotic, requiring oxygen and aminophyllin, and again recovered. Discharged from hospital to return six months later with another episode of sudden pulmonary failure. Still living although there have been several minor episodes of pulmonary embarrassment. No evidence of cardiac disease. Is also being treated for eczema and food allergy.

**Findings** Extensive edema of lungs accompanying the episode of acute dyspnea and cyanosis, with rapid clearing indicated in films made seven and nine days later.

**Diagnosis** *Recurrent periarteritis nodosa or allergic state of pulmonary vessels*

**Comment** The history and findings suggest repeated bouts of pulmonary edema due to increased permeability of small pulmonary vessels. It is possible that the vessel walls have been sensitized to some toxin or allergen to which they are exposed intermittently.

the pulmonary changes are unique, explosive in character, and associated with signs and symptoms of acute pulmonary failure. The roentgen shadows are massive and symmetrical, extending out from the hilum to the middle lung zone, giving the appearance of a "corona" around the mediastinum (Figs 8 and 9). These extensive changes may disappear within forty-eight hours and the patient become comfortable again, particularly if anti-spasmodic and anti-allergic drugs are administered. It is thought that the sudden onset and rapid clearing of these shadows are due to changes in permeability of vessel walls such as occur in urticarial responses in the skin. The patient may have several such attacks over a period of months, and the eventual prognosis is grave. Occasionally, the acute episode will be followed by a chronic illness with which symptoms of other diseases, such as asthma, dermatitis, or food sensitivity, may be associated (Fig 10).

In the chronic form of periarteritis nodosa, the roentgen findings are much less prominent and characteristic. Small hazy shadows may be scattered through the peripheral lung fields and at the lung bases, associated with increased prominence of

the pulmonary vascular markings (Fig 11). To the uncritical eye the appearance suggests a bronchopneumonia, but the peripheral and patchy nature of the shadows is unusual for inflammatory disease. Although the clinical course indicates chronic disease, serial roentgen examinations of the chest will show migration of the shadows, with the changing pattern that has been described in the so-called Loeffler's syndrome.

"*Loeffler's Syndrome*" "*Loeffler's syndrome*" is the term originally used to describe an acute disease with mild symptoms and signs, associated with migratory pulmonary shadows on the roentgenogram, and an eosinophilia in the blood and sputum (27). It has always been considered a manifestation of allergy and it would therefore seem more appropriate to designate it as a non-specific hypersensitivity state rather than consider it a definite syndrome or disease (28). Furthermore, it is quite possible that the picture may be produced as a pulmonary reaction to an extrinsic antigen present locally, or occur as a reflection of a generalized hypersensitivity state of the vascular system of the body as a whole, as indicated in the discussion of the preceding diseases.

"Chronic Loeffler's syndrome" has been described in association with infestation with certain parasites (29), but it is apparent that this is not a separate entity, but one in which an overt antigen can be recognized (Fig 12). In this condition, it should be pointed out that the total white blood count and eosinophilia may reach an astoundingly high figure. Some of the sporadic case reports of eosinophilic leukemia in children (30) may actually be descriptions of a chronic hypersensitivity state associated with parasitism.

#### DISCUSSION

No attempt has been made to discuss in detail the pathological, clinical, or radiological features of all diseases affecting the pulmonary vascular tree, many of which are accompanied by a hypersensitivity state in which the peripheral blood vessels of the lung participate. Reference to Table II will indicate that this list is incomplete, furthermore it omits many borderline states, such as asthma and allergy in tuberculosis and pneumococcus pneumonia, which need further investigation. It is clear, however, that the diseases from the table which have been illustrated present a uniform pathological, clinical, and radiological pattern. While it is obvious that this pattern is in no way specific for the various clinical entities, it is sufficiently characteristic of the group as a whole to deserve wide recognition. It may be necessary to employ serial roentgen examinations before one can distinguish the characteristics of peripheral pulmonary vascular disease, and this method of investigation should be used freely in all cases with roentgen shadows of obscure etiology.

By careful study, however, it may be possible in many instances to determine whether disease in the chest is affecting primarily pulmonary, lymphatic, or vascular structures by the nature and distribution of the roentgen shadows (14), and this preliminary analysis is often useful in differential diagnosis. Radiologists, therefore, have a unique opportunity of identi-

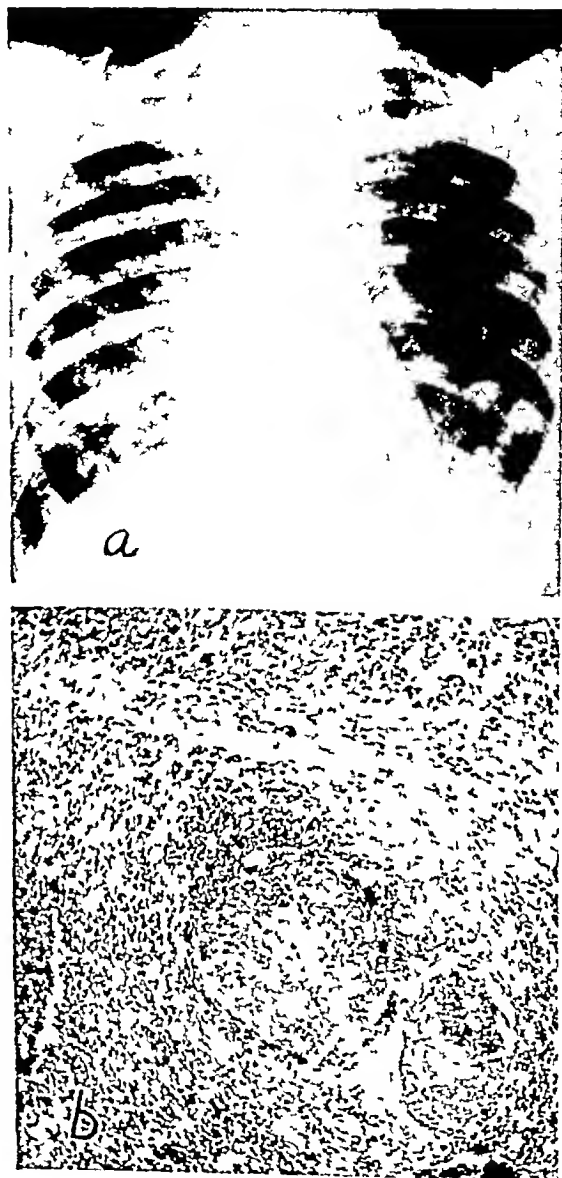


Figure 11

**History** Severe pain in the abdomen for three weeks and previous history of chronic cough. Signs of bronchopneumonia in the chest during hospitalization and an eosinophilia of 75 per cent before death.

**Findings** Small irregular areas of consolidation scattered throughout both lungs, tending to peripheral distribution.

**Diagnosis** *Periarteritis nodosa*.

**Pathology** Pancreas tissue  $\times 150$ . Several blood vessels are shown with marked necrosis of all coats in their walls and heavy inflammatory infiltration of surrounding tissues. This lesion is characteristic of *periarteritis nodosa*. In parts of the section not shown there were vessels showing healed lesions, indicating that the disease was of at least several months duration.

**Comment** The roentgenogram made sometime before death does not show the shadows characteristic of vascular disease at its height. It does show changes which might be encountered in subacute or chronic vascular disease or latent *periarteritis nodosa*.

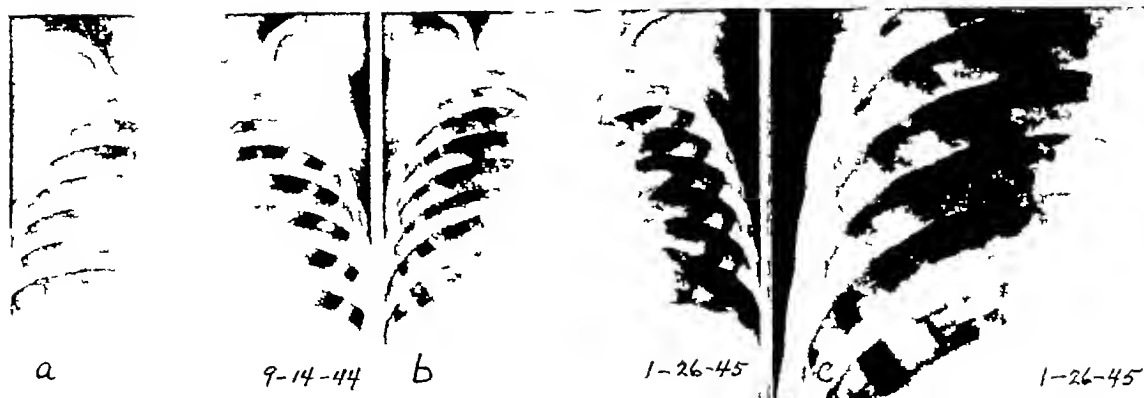


Figure 12

**History** Hospitalization because of fever and productive cough of several months duration Enlarged liver and spleen W B C 56 000 with 81 per cent eosinophiles Liver biopsy revealed eosinophilic infiltration Stool examination repeatedly negative Patient finally passed a single male *Ascaris* No ova or parasites in lungs Eventual recovery

**Findings** Serial studies showed increasing infiltration of inner half of each lung, resembling chronic symmetrical bronchopneumonia Appearance suggestive but not characteristic of pulmonary vascular disease

**Diagnosis** Allergic state due to sensitization to products of *Ascaris* Chronic Loeffler's syndrome

**Comment** Chronic Loeffler's syndrome due to sensitization to parasites has been recently described by others In our patient the lung changes were not due to the local presence of ova or parasites

fying the roentgen appearance of the chest in many otherwise obscure clinical states, and relating it to the fundamental pathologic lesion of peripheral vessels which the chest roentgenogram may so accurately reflect

#### CONCLUSION

An attempt has been made to present from a new point of view the roentgen appearance of the chest in diseases which may be associated with hypersensitivity states of the peripheral vascular system or damage to the vessel walls leading to increased permeability It is believed that conditions such as epidemic influenza, lupus erythematosus, acute rheumatic fever, exfoliative dermatitis, acute glomerulonephritis, and periarteritis nodosa, which have a similar background in pathology, may also present a distinctive roentgen pattern in the lungs The radiologist, aware of these facts, may be forearmed to render better service in the differential diagnosis of many of these obscure diseases

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#### BIBLIOGRAPHY

- 1 BRENNER, O Pathology of the Vessels of the Pulmonary Circulation Arch Int Med 56 457, 724 976, 1935
- 2 KROHN, P L, WHITTERIDGE D, AND ZUCKERMAN S Physiological Effects of Blast Lancet 1 252-258 Feb 28 1942
- 3 MECRAV P M JR, BARDEN, R P AND RAVDIN I S Nutritional Edema Surgery 1 53-64 January 1937
- 4 WILLIAMS W F Personal communication
- 5 WEISS S AND WILKINS R W Nature of the Cardiovascular Disturbances in Vitamin Deficiency States Tr A Am Physicians 51 341-373, 1936
- 6 WALDENSTRÖM J Relapsing Diffuse, Pulmonary Bleedings or Hemosiderosis pulmonum—New Clinical Diagnosis Acta radiol 25 149-162 1944
- 7 GILBERT, A J Microscopic Observations of Pulmonary Artery Reactions J Pharmacol & Exper Therap 62 228-235 February 1938
- 8 RACKEMANN, F M Allergy Review of Literature of 1943 Arch Int Med 73 248-266, March 1944
- 9 GREGORY J E AND RICH A R Experimental Production of Anaphylactic Pulmonary Lesions with Basic Characteristics of Rheumatic Pneumonitis Bull Johns Hopkins Hosp 78 1-12 January 1946
- 10 HARKAVY J Vascular Allergy Pathogenesis of Bronchial Asthma with Recurrent Pulmonary Infiltrations and Eosinophilic Polyserositis Arch Int Med 67 709-734 April 1941

- 11 HARKAVY, J Vascular Allergy *J Allergy* 14 507-537, November 1943
- 12 GRANT, R T Observations on Periarteritis Nodosa *Clin Sc* 4 245-276, 1939-1942
- 13 RICH, A R. Role of Hypersensitivity in Pathogenesis of Rheumatic Fever and Periarteritis Nodosa *Proc Inst Med Chicago* 15 270-280, March 15, 1945
- 14 LODGE T Anatomy of the Blood Vessels of the Human Lung as Applied to Chest Radiology *Brit J Radiol* 19 1-13, 77-87, 1946
- 15 STUART-HARRIS, C H Influenza Epidemics and the Influenza Viruses *Brit M J* 1 209-216 Feb 17, 1945
- 16 BAEHR, G, AND POLLACK, A D Disseminated Lupus Erythematosus and Diffuse Scleroderma *J A M A* 134 1169-1173, Aug 2, 1947
- 17 KLOTZ, O Rheumatic Fever and the Arteries *Tr A Am Physicians* 27 181-187, 1912
- 18 PAPPENHEIMER A M, AND VON GLAHN, W C Specific Lesions of Peripheral Blood Vessels in Rheumatism *Am J Path* 2 235-249, May 1926
- 19 GRIFFITH G C, PHILLIPS, A W, AND ASHER C Pneumonitis Occurring in Rheumatic Fever *Am J M Sc* 212 22-30 July 1946
- 20 KLEMPERER P Personal communication
- 21 EPSTEIN E Z AND GREENSPAN E B Rheumatic Pneumonia *Arch Int Med* 68 1074-1094, December 1941
- 22 COSTELLO, M J, AND LANDY, S Dermatitis exfoliativa Following Arsphenamine Therapy *New England Journal of Medicine* 232 369-372, March 29, 1945
- 23 FISHBERG A M Hypertension and Nephritis Philadelphia, Lea & Febiger, 4th edition, 1939, pp 178-179
- 24 RACKEMANN F M, AND GREENE, J E Periarteritis Nodosa and Asthma *Tr A Am Physicians* 54 112-118, 1939
- 25 MATSUI Quoted by LEWIS, T, and LANDIS E *Heart* 15 329-350, July 1931
- 26 ELKELES, A AND GLYNN L E Serial Röntgenograms of the Chest in Periarteritis Nodosa as an Aid to Diagnosis, with Notes on Pathology of Pulmonary Lesions *Brit J Radiol* 17 368-373 December 1944
- 27 HENNEL, H AND SUSSMAN M L Roentgen Features of Eosinophilic Infiltrations in the Lungs *Radiology* 44 328-334, April 1945
- 28 BAYLEY E C, LINDBERG, D O N AND BAG GENSTOSS, A H Loeffler's Syndrome *Arch Path* 40 376-381, November-December 1945
- 29 Transitory Pulmonary Infiltrations Associated with Eosinophilia Loeffler's Syndrome (editorial) *J A M A* 126 837, Nov 25, 1944
- 30 BASS, M H Eosinophilic Leukemia, Case in Child Aged 8 Years *Am J Dis Child* 41 1394-1402, June 1931

## SUMARIO

### Aspecto Roentgenológico del Tórax en las Enfermedades que Afectan el Aparato Vascular Periférico de los Pulmones I Estados Asociados a Hiperpermeabilidad Vascular

Trátase aquí de presentar desde un nuevo punto de vista el aspecto roentgenológico del tórax en las enfermedades que pueden asociarse con hipersensibilidad del aparato vascular periférico o lesiones de las paredes vasculares que conducen a hiperpermeabilidad. Estados tales como influenza epidémica, lupo eritematoso, reumatismo agudo, dermatitis exfoliativa,

glomerulonefritis aguda y periarteritis nodosa, que tienen un fondo patológico semejante, pueden también presentar un cuadro roentgenológico distintivo en los pulmones. El radiólogo, al tanto de estos hechos, puede armarse de antemano para prestar mejor servicio en el diagnóstico diferencial de muchas de esas enfermedades aun oscuras.



# Pulmonary Edema

## A Correlation of X-Ray Appearance and Physiological Changes<sup>1</sup>

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EDEMA OF THE lungs produces shadows on roentgen examination which may be confused with those due to other conditions. Most frequently they simulate pneumonia. Other pulmonary diseases which cause diffuse shadows, such as coccidioidomycosis, Boeck's sarcoid, and miliary tuberculosis, may occasionally cause confusion, and pulmonary infarcts sometimes produce a picture resembling that of edema. It is the purpose of this paper to discuss the factors involved in the production of pulmonary edema, and to correlate these with the roentgen findings.

Although the roentgen appearance of edema of the lungs varies considerably, certain constant features are seen in the majority of cases. (1) Edema tends to be diffuse and bilateral. Local or segmental involvement may occur, but it is the exception rather than the rule. (2) The apices and extreme bases tend to be clear. (3) There is often a diffuse increase in density of the lung fields, due to the increase in the caliber of the vascular shadows and small focal areas of alveolar edema. (4) A rather rapid shift in position or variation in extent is apparent on serial films. (5) The heart is usually enlarged.

### CAUSES OF PULMONARY EDEMA

Pulmonary edema is caused by or associated with a wide variety of pathological conditions. The present discussion will be limited to pulmonary edema occurring in conjunction with (1) cardiac failure, (2) nephritis, and (3) excessive parenteral administration of fluids.

Three basic physiological changes singly or in combination may cause pulmonary edema. They are increased intracapillary hydrostatic pressure, decreased osmotic

pressure of the blood, and altered permeability of the capillary wall.

The normal hydrostatic pressure in the alveolar capillaries is estimated at between 8 and 10 mm Hg. This is approximately 15 mm lower than in the capillaries of the systemic circulation. The osmotic pressure of the blood is constant throughout the entire cardiovascular system. It is normally 25 to 30 mm Hg. This pressure is an attracting force opposing the hydrostatic pressure, which, if greater than the osmotic pressure, will cause fluid to diffuse out of the capillary into the interstitial tissues. The osmotic pressure of the blood is due largely to the serum protein, the normal level of which is about 7 gm per cent. The constituents of the serum protein which create osmotic pressure are the serum albumin and globulin, which are normally present in a proportion of 4.4 gm per cent albumin to 2.6 gm per cent of globulin. The albumin molecule is considerably smaller than the globulin molecule. Thus, in conjunction with the greater relative quantity of albumin, causes it to exert most of the osmotic pressure. Each gram per cent of serum albumin creates osmotic pressure estimated as 5.5 mm Hg. Each gram per cent of serum globulin exerts a pressure of 1.4 mm Hg.

The normal capillary wall is a semipermeable membrane which allows a free diffusion of water and electrolytes and a limited diffusion of serum protein. It is estimated that normally, in passage through a capillary, less than 5 per cent of the serum protein leaves the vessel and enters the interstitial tissues. An increase in capillary permeability, however, causes a diffusion of serum protein, water, and electrolytes into the tissues. A variety of toxic agents, both metabolic and extrinsic,

<sup>1</sup> Accepted for publication in September 1947.

and of neurogenic influences, direct or reflex, cause increased capillary permeability

The shadows produced by pulmonary edema are not uniformly distributed, even in the central portions of the lung, although they tend to become confluent as edema becomes more marked. This lack of uniformity in the distribution of edema is due to the variability of capillary permeability in different parts of the lung. It is known that capillaries vary markedly in size, some being constricted and others dilated. Dilated capillaries will have a greater surface for diffusion than contracted capillaries. Because of stasis, the hydrostatic pressure may be greater in the dilated than in the constricted capillary. This will cause a diffusion of edema fluid to occur initially where the capillaries are dilated and probably accounts for the patchy distribution of edema so frequently seen. The tendency to a shift in position may be due to the ability of capillaries in the edematous part of the lung to contract and of others to dilate. The contracted capillary will take up the edema because of reduced hydrostatic pressure with contraction.

Anoxia has been shown experimentally to produce edema by increasing capillary permeability. There are certain features, however, which suggest that this alone is not the responsible factor. If anoxia caused edema, a vicious cycle would be established which, once set in motion, would be irreversible. It is probable that anoxia induces neurogenic reflexes leading to increased capillary permeability. Edema, so induced, rapidly clears with adequate oxygenation of the blood. This would suggest a central neurogenic control, as local oxygenation would not take place until the edema had been cleared.

In other parts of the body, impaired lymphatic drainage is not infrequently associated with edema. In the lung this may play an accessory role in the production and maintenance of pulmonary edema due primarily to other causes. Pulmonary edema, however, is never due solely to lymphatic stasis. The lung is bountifully endowed with lymphatics, though the

terminal lymphatic vessels end at the atria and do not enter the alveolar walls. The lymphatics aid in the disposal of fluid, secretions and foreign material in the bronchial tree but cannot aid in clearing the alveoli. Other mechanisms for clearing of the bronchial tree are the ciliary action of the bronchial epithelium, peristalsis of the bronchial walls, and coughing.

The alveoli are physiologically designed by nature to be dry. The difference between the intracapillary osmotic pressure and hydrostatic pressure creates a strong negative pressure, tending to cause water to pass from the alveolus into the blood. This is well illustrated by Colin's experiment, in which 31 liters of water were introduced intratracheally into a horse's lungs during a two-hour period with no ill effects. The usual ill effects of water aspiration in man are due not to the water reaching the alveoli but to that which remains in the bronchi and mixes with the mucus to form a frothy fluid which obstructs the airway. This in turn causes increased permeability of the capillary wall because of anoxia, with resultant alveolar edema. Lungs of persons drowned in sea water show no sea water in the alveoli but edema fluid containing protein.

#### EDEMA FROM HEART FAILURE

Pulmonary edema seen in association with left-sided cardiac failure is due to an increase in hydrostatic pressure and capillary permeability. The increase in hydrostatic pressure is a result of the tamponade effect on the pulmonary veins produced by the failure of the left side of the heart. The increase in capillary permeability is caused by one or a combination of two factors, anoxia and neurogenic influences.

The roentgen picture in pulmonary edema associated with left cardiac failure differs depending on whether the failure is acute or chronic.

In chronic cardiac failure the increase in hydrostatic pressure is slower, and the effect of gravity and stasis in the dependent parts of the lungs causes edema to occur there first. Pleural effusion is a frequent



Fig 1 Case I Acute pulmonary edema with left heart failure C McK, a 27 year old man was admitted because of fainting attacks of one month duration His blood pressure was 110/60, pulse 45 Both aortic and mitral murmurs were heard The admission chest film showed an enlarged heart and calcium was demonstrable fluoroscopically in region of the aortic valve Four days before death substernal pain and dyspnea developed and in the last three days of life there was increasing lung edema A chest film taken the day before death showed vascular congestion with associated pulmonary edema

At autopsy edema of both lungs was found The right lung weighed 1,250 gm the left 1 040 gm The heart weighed 740 gm Extensive calcific disease of the aortic valves, with extension of the calcification into the auriculoventricular bundle explained the heart block

accompaniment This may be caused by stasis in the capillaries supplying the visceral pleura, which drain into the pulmonary veins The upper lung fields are usually clear, although the vascular markings are more prominent than usual The configuration of the heart again depends on the type of heart disease with which the patient is afflicted

The physiological basis for the distribution of the edema is illustrated by Drinker's experiments on dogs He produced pulmonary stasis in healthy dogs by placing them on their backs and strapping their abdomens and lower chests, keeping them under anesthesia with nembutal for five

hours At the end of that time, he rapidly injected 22 c c of a suspension of very finely divided graphite in 6 per cent acacia-physiological saline into an external jugular vein One minute later the dog was rapidly bled to death At necropsy the lungs showed congestion and edema in the dependent parts The graphite was plenti-



Fig 2 Case II Acute heart failure with pulmonary edema M P a 55-year-old man on admission, complained of marked shortness of breath and sweating of four hours duration He had had exertional and paroxysmal nocturnal dyspnea for one month Findings on physical examination were temperature 100.8°, pulse 120, blood pressure 80/70 respirations 28 The patient presented the picture of shock with cyanosis cool moist extremities and rapid thready pulse Clinical evidence of pulmonary edema was present and a single film of the chest showed the typical appearance of that condition

Death occurred the day following admission At autopsy old and recent myocardial infarctions and edema of both lungs were found The right lung weighed 1 000 gm, the left 900 gm

Pulmonary edema is frequently not seen with myocardial infarction This is presumably because there is a concomitant failure of both the right and left ventricles placing no additional load on the pulmonary circulation

fully distributed in the upper part of the lungs, where circulation and ventilation were normal, but was practically absent in the congested tissue The lungs of these dogs were similar to those of the elderly bed-ridden non-cardiac patient with shallow breathing, collapse of alveoli, and cir-

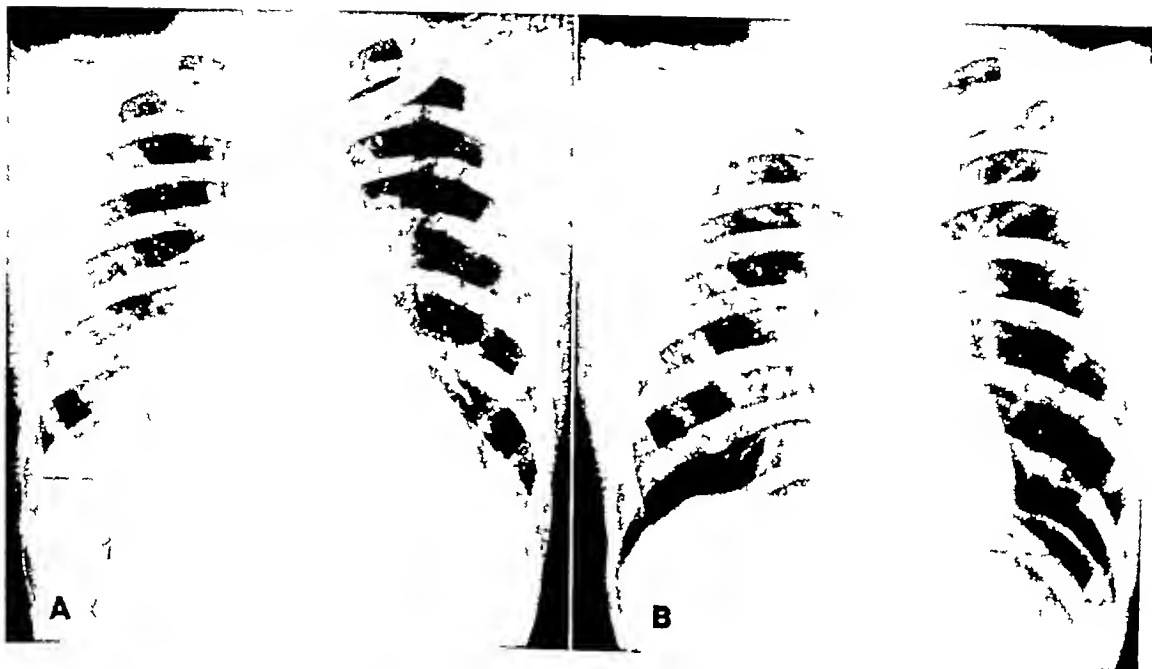


Fig 3 Case III Pulmonary edema associated with acute glomerulonephritis A 14-year-old boy complained on admission of swelling of the face and ankles of four days duration His blood pressure was 180/85 Facial and ankle edema were present Urine examinations showed albumin 3 plus with casts white blood cells and red blood cells seen microscopically The serum protein was 6.7 gm per cent and the non protein nitrogen 35 mg per cent The chest film on the day of admission (A) showed definite enlargement of the heart, an increase in the pulmonary vascular shadows and edema in the right lung A film obtained twelve days later (B) showed reduction in the heart size and clearing of the lungs The patient made a complete clinical recovery The pulmonary edema in this case was due to the elevation of the blood pressure with associated cardiac enlargement and left heart failure causing an increase in the hydrostatic pressure in the pulmonary circulatory bed There was at no time urinary suppression and excessive fluids were not administered

culatory stasis and to the lungs of patients with chronic cardiac failure In the latter condition, the increased pulmonary vein pressure leads to stasis, first in the dependent part of the lung, with subsequent anoxia, increased capillary permeability, and diffusion of edema fluid into the interstitial tissue and alveoli There is associated obstruction of the smaller bronchioles by edema fluid This creates an excellent medium for infection, which in the debilitated or elderly patient rapidly leads to a superimposed pneumonitis

In acute failure there is a pronounced increase in the vascular shadows, due to the impaired venous return from the lung The edema tends to occur in the central portion of the lungs The apices and extreme bases are usually clear and there is seldom any associated pleural effusion (Figs 1 and 2)

The reasons for the central location of the pulmonary edema in acute cardiac

failure are not so well understood Dock has advanced a thesis for the central congestion in patients with associated renal and cardiac failure He suggests that the pulmonary hyperventilation associated with acidosis prevents collapse of alveoli in the peripheral lung fields This, in turn, reduces circulatory stasis Respiratory excursion is an important factor in preventing pulmonary stasis Normal respiration creates a negative pressure of 5 to 10 mm Hg, and expiration a like positive pressure Forced inspiration and expiration may raise these pressures as high as 70 to 80 mm Hg These pressure changes not only influence the exchange of air but aid the pulmonary circulation

The lung, in its ability to contract and expand, may be compared to a fan which opens and closes about a relatively stationary hilum The most peripheral part of the lung, like the most peripheral part of a fan, will have the greatest excursion The

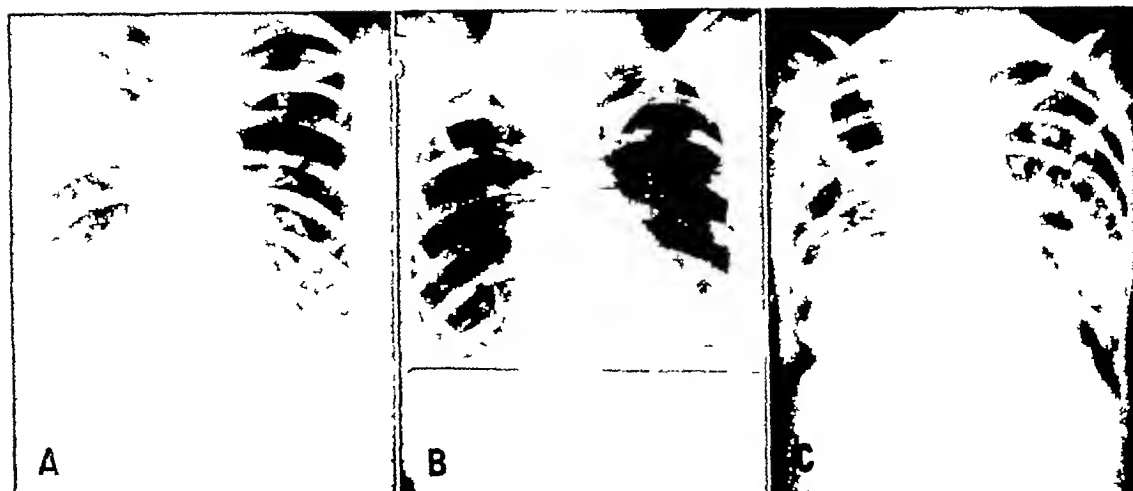


Fig 4 Case IV Uremia with associated lung edema O S, a 29 year old white woman, complained on admission of headaches and repeated epistaxis Her blood pressure was 150/90 Urinalysis showed 2 plus albumin with red blood cells and hyaline casts on microscopic examination The urea nitrogen was 55 mg per cent on admission The admission chest film (A) showed shadows of increased density in the right upper lung field and in the right lower medial lung field which were interpreted as being due to pneumonia However, the patient was afebrile, and there was no clinical or laboratory evidence of pneumonia These shadows cleared completely during the next three weeks as indicated by the second film (B) At this time the patient had clinical evidences of pericarditis and the configuration of the heart suggests a pericardial effusion (B) The patient became progressively more uremic and died on the 86th hospital day During the last month a generalized pulmonary edema developed which slowly increased in extent This is shown on the film (C) taken five days before death During the later part of the course the blood pressure rose and there was associated cardiac failure

At autopsy both lungs were edematous The right lung weighed 720 gm, the left 500 gm There were small areas of lobular pneumonia also present The kidneys were small and scarred and both grossly and microscopically presented findings consistent with chronic glomerulonephritis Pericarditis was also found

apices alone are relatively immobile With a sudden increase in pressure throughout the pulmonary venous circuit and adequate respiratory excursion, the greatest exchange of oxygen and carbon dioxide will continue to take place in the lung periphery The relatively greater excursion of this part of the lung will also aid mechanically in keeping the capillary blood flowing In the central portion of the lung the respiratory excursion is less and stasis greater The increased capillary hydrostatic pressure due to the greater stasis will cause central edema

#### PULMONARY EDEMA WITH NEPHRITIS

Pulmonary edema associated with nephritis may be due to any one or a combination of two or all three of the physiological factors enumerated earlier in this paper With the pure nephrotic type of nephritis, with a marked lowering of the serum protein and no elevation of the non-protein nitrogen edema is most pronounced in the dependent parts of the body In the lung

the safety factor of the low hydrostatic pressure (10 mm Hg) allows a marked drop in serum protein before the attracting force of the osmotic pressure is sufficiently reduced to allow the occurrence of edema As the disease progresses, however, extremely low serum protein levels are attained with a reversal of the albumin-globulin ratio, and pulmonary edema may then ensue Bell reports two cases of nephrosis with death from pulmonary edema

Pulmonary edema may occur with acute glomerulonephritis or with terminal glomerulonephritis and uremia Although there may be associated cardiac failure, edema occurs in the absence of clinical evidence of this latter condition

With acute glomerulonephritis, edema may occur with normal serum protein levels and very little elevation of the non-protein nitrogen Edema in these cases is presumably due to toxic factors, the nature of which is not clear These cause an increase in capillary permeability The

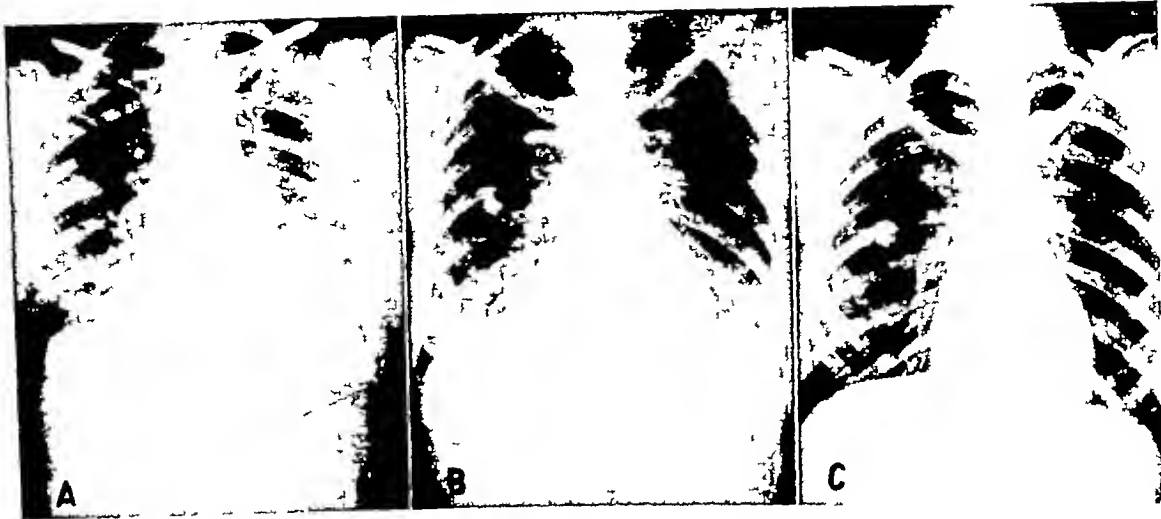


Fig 5 Case V Pulmonary edema associated with excessive administration of fluids M G, a 31-year old single white female was admitted Feb 6, 1946, complaining of fever and chills of three days duration The patient was known to have had hypoadrenalism for six years, due to tuberculosis of the adrenals In addition, she had pulmonary and renal tuberculosis None of the three foci had shown any recent signs of activation On admission the patient showed evidences of a mild Addisonian crisis She was given 10 mg of Doca (desoxycorticosterone) and adrenal cortical extract She had previously been on Doca 2.5 mg daily During the first sixty hours after admission she received a total fluid intake of 7,600 c c parenterally

The admission chest film was negative except for a nodular tuberculous focus in the right mid lung field On Feb 9 three days later, a re-examination (A) showed cardiac enlargement, an increase in the size of the vascular lung shadows and small focal areas of edema in both lungs Following reduction of fluid administration and of the Doca dosage the lungs cleared, as shown by films obtained four (B) and eleven (C) days later

This case illustrates pulmonary edema caused by excessive administration of fluids and due to increased blood volume The increase in blood volume created an increase in the hydrostatic pressure, which was directly responsible for the edema The increase in hydrostatic pressure was reflected in the systemic circulation by a rise in the venous pressure in the antecubital vein to 150 mm of water The serum protein level on Feb 9 was 5.7 gm per cent If this had been lower, the edema would have been more pronounced Pulmonary and peripheral edema may be seen with desoxycorticosterone overdosage

edema usually occurs in places of lowered tissue resistance, as beneath the eyes and in the hands and feet If pulmonary edema occurs, it is usually due to an associated cardiac insufficiency brought on by a rapid rise in the blood pressure (Fig 3) Toxic factors may play a role in increasing capillary permeability

With late terminal glomerulonephritis there is invariably an elevation of the urea nitrogen, and in approximately four-fifths of the cases the blood pressure rises There is frequently but not invariably an associated cardiac failure In some patients pulmonary edema precedes death by several days or weeks

The physiological defect responsible for pulmonary edema in pure nephritis without associated cardiac failure is increased capillary permeability The reasons why some lung capillaries are affected while others are not is not clear The chest films

in these cases show focal areas of edema which may be localized or diffuse (Fig 4) There may be little enlargement of the vascular shadows or of the heart

#### PULMONARY EDEMA DUE TO EXCESSIVE ADMINISTRATION OF PARENTERAL FLUIDS

Pulmonary edema is occasionally seen in hospitalized patients who have received excessive amounts of water and salt intravenously Large amounts, 3-5 liters of physiological saline daily for several days, may not be promptly excreted by the kidneys The consequent increase in the blood volume increases the hydrostatic pressure within the capillaries and causes a diffusion of water and salt with some of the serum protein into the interstitial tissues If the serum protein is low, this train of events will be initiated sooner because of the lowered osmotic pressure of the blood If at the outset the serum protein level is

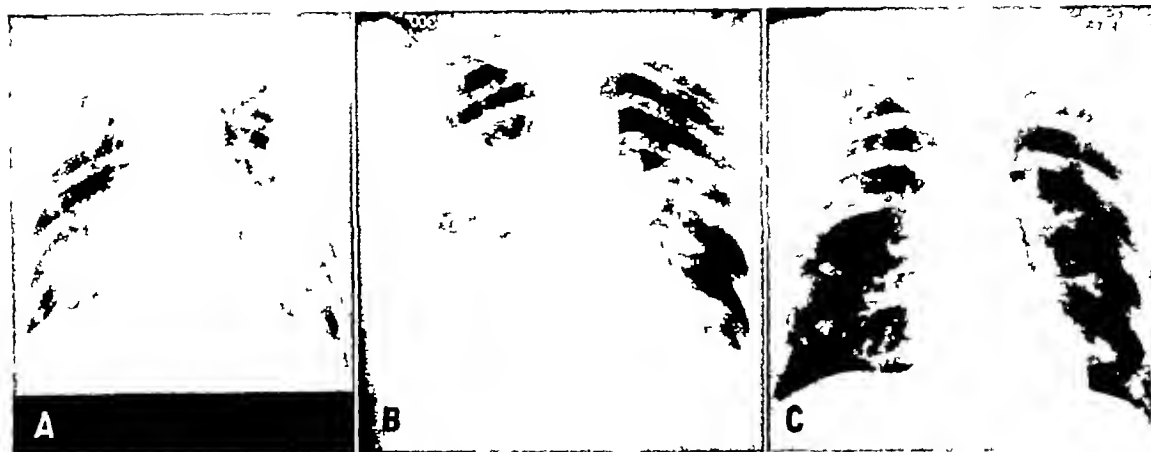


Fig 6 Case VI Pulmonary edema associated with excessive parenteral fluid intake S R a 51-year old man was admitted Sept 14 1943, because of increasing abdominal pain A roentgenogram of the abdomen showed evidence of mechanical ileus A Miller-Abbott tube was inserted on Sept 16 Because the patient appeared dehydrated large amounts of intravenous saline were given, commencing Sept 17 An average of 4 200 c c was given daily for six days There is no record of the fluid output On Sept 18 the temperature rose, reaching  $104^{\circ}\text{F}$  on the following day The serum protein was found to be 5.1 gm per cent The patient's physician felt that the pulmonary changes were due to pneumonia and continued fluid administration and gave sulfa diazine On Sept 22, 900 c c of plasma was given and on Sept 24 the excessive fluid intake was discontinued Sulfadiazine was discontinued Sept 26

Films of the chest showed edema of the lungs and right pleural effusion There was also enlargement of the heart Films A and B, Sept 20 and 23, illustrate the shifting position and variation in extent of edema As shown by film C, Sept 27 rapid resolution of the edema and decrease in the heart size followed reduction of the fluid intake and plasma infusion While the possibility of an associated pneumonia could not be excluded on either of the first two films, the rapid resolution (four days) after correction of the abnormal physiology would suggest that the lung findings were entirely due to edema

This case illustrates the effects of excessive fluid administration The lowering of the serum protein was due both to lack of adequate intake and increased loss through the capillary bed The pulmonary edema was due to the increase in hydrostatic pressure caused by rapid and excessive administration of fluid and lowering of the osmotic pressure of the blood It is interesting to note that there was no peripheral edema

normal, it will rapidly drop, because of increased diffusion, to below the threshold level It is readily seen that the continued administration of saline will produce a vicious cycle It might be noted that the urinary output is invariably less than would be anticipated with the fluid intake Pulmonary edema may occasionally be present without edema being evident elsewhere

These patients can be promptly relieved by discontinuance of the administration of excessive fluids and restoration of the depleted protein According to Jones and Eaton, infection, inadequate protein intake or failure of absorption, and excessive blood loss may all be predisposing factors in production of the lowered serum protein blood level

On x-ray examination the heart is found to be enlarged There is an increase in the vascular markings in the lung fields Pleural effusion frequently accompanies the

lung edema The location and extent of the edema vary on serial examination (Figs 5 and 6)

As mentioned above, the shadows produced by pulmonary edema on the x-ray film are most frequently confused with those seen in pneumonia The common error is not to overlook the possibility of pneumonia, but to fail to consider edema Despite an elevated temperature, the clinician's attention should be called to the possibility of edema if the roentgenogram suggests its presence Failure to institute corrective measures for pulmonary edema may be as disastrous as failure to treat pneumonia

#### SUMMARY

Pulmonary edema produces shadows on chest films that simulate other conditions Certain features, however, help to differentiate edema in most instances These are (1) the diffuseness of the shadows, (2)

relative clearness of the extreme apical and basal lung fields, (3) a tendency for the shadows to vary in size and to show a shift in location on serial films, (4) enlargement of the vascular shadows, (5) enlargement of the heart

The underlying physiological factors in the production of pulmonary edema are discussed. These are (1) increased intracapillary hydrostatic pressure, (2) decreased osmotic pressure of the blood, (3) increased capillary permeability

Pulmonary edema seen in association with heart failure, nephritis, and excessive parenteral fluid intake is discussed and illustrative cases are presented. Clinical correlation is essential in determining the responsible disease and abnormal physiology. The shadows seen in the lung fields with edema depend on the interplay of the three physiological factors

Local or segmental edema is not discussed. The reasons why edema may

occur unilaterally or segmentally are not clear. This may be related to the neurogenic control of capillary size and permeability

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#### REFERENCES

- BELL, E T. *Renal Disease*. Philadelphia, Lea & Febiger 1946
- BEST, C H, AND TAYLOR, N B. *The Physiological Basis of Medical Practice*. Baltimore, Williams & Wilkins Company 3d ed 1943
- COLIN, G. *Traité de physiologie comparée des animaux*. Paris, J B Ballière et Fils, 2nd ed, 1871-1873 pp 109-110
- DRINKER, C K. *Pulmonary Edema and Inflammation*. Cambridge, Harvard University Press, 1945
- DRINKER, C K, AND FIELD, M E. *Lymphatics, Lymph and Tissue Fluid*. Baltimore, Williams & Wilkins Co, 1933
- DOCK, W. The Evil Sequelae of Complete Bed Rest. *J A M A* 125 1083-1085, Aug 19, 1944
- JONES, C M, AND EATON, F B. Postoperative Nutritional Edema. *Arch Surg* 27 159-177, July 1933
- MILLER, W S. *The Lung*. Springfield, Ill, Charles C Thomas, 1937
- NESSA, CURTIS B, AND RIGLER, LEO G. Roentgenological Manifestations of Pulmonary Edema. *Radiology* 37 35-45 July 1941

#### SUMARIO

#### Edema Pulmonar. Correlación del Aspecto Roentgenológico y las Alteraciones Fisiológicas

El edema pulmonar produce en las películas torácicas sombras que simulan otros estados, aunque ciertas características ayudan a diferenciarlo en la mayor parte de los casos. Consisten las mismas en (1) difusidad de las sombras, (2) relativa claridad de los campos de los extremos del vértice y la base del pulmón, (3) tendencia de las sombras a variar de tamaño y a desviar en las películas seriadas, (4) agrandamiento de las sombras vasculares, y (5) hipertrofia cardíaca

Discútense los factores fisiológicos subyacentes en la producción del edema pulmonar, o sean (1) hipertensión hidrostática intracapilar, (2) hipotensión os-

mótica de la sangre, (3) hiperpermeabilidad capilar

Estúdiase el edema pulmonar asociado a insuficiencia cardíaca, nefritis y excesiva ingestión parentérica de líquidos, presentándose casos típicos. La correlación clínica es indispensable para determinar la afección causante y la fisiología anormal. Las sombras observadas en los campos pulmonares con edema dependen de la interacción de los tres factores fisiológicos

No se discute el edema local o segmentario. Las razones por las que puede ocurrir edema puramente unilateral o segmentario no son claras, y puede intervenir en ello la regulación neurógena del tamaño y permeabilidad de los capilares

# Mesenteric Lipoma in a Child

## Roentgenologic Visualization<sup>1</sup>

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IT IS GENERALLY known among radiologists that fat is translucent to roentgen rays, casting a shadow intermediate in density between that of air and water. According to Laurell (18), this observation was first recorded by A Kohler, in 1915, and subsequently by Grashey, in 1924. The first lipomas to be observed roentgenographically were situated mainly in the extremities. Thus, Bufalini (7) in 1925 reported an intramuscular lipoma of the arm, revealed on roentgen examination by its relatively radiolucent shadow.

The first instances of *intra-abdominal* fatty tumors actually visualized preoperatively were three cases published by Odqvist (21) in 1926. All three had been diagnosed roentgenologically as dermoids, and in two this diagnosis was confirmed at operation. The third proved to be a retroperitoneal lipoma, and it will be shown later that this error in differential diagnosis is frequently unavoidable. It should be emphasized that previous publications had dealt exclusively with fatty tumors in more superficial locations.

More recently Windholz (33) has reported the preoperative diagnosis of three fatty retroperitoneal tumors, of which two were lipomas and one a fibromyxoliposarcoma.

In Table I are presented the publications dealing with the roentgen diagnosis of radiolucent fatty tumors.

The great majority of the 33 reported visualized tumors have been lipomas of the extremities. Only 7 have been demonstrable in deep sites (Table II).

There have also been a number of reports of fatty tumors which either were not visualized or appeared only as a dense

TABLE I FATTY TUMORS VISUALIZED ROENTGENOGRAPHICALLY BY RADIOLUCENT APPEARANCE

Author No of Cases	Site	Type of Tumor
Bufalini (7)		
1	Arm	Lipoma
Odqvist (21)		
2	Abdominal	Dermoids
1	Retroperitoneal	Lipoma
Schütz (26)		
1	Forearm	Lipoma
Laurell (18)		
1	Thigh	Lipoma
1	Abdominal wall	Lipoma
1	Ventral hernia	Fatty mass
Chasin (9)		
3	Extremities	Lipomas
Reiss (24)		
2	Forearm	Lipomas
Tagliavacche (30)		
1	Arm	Lipoma
Brown and Grollman (6)		
1	Thigh	Lipoma
Templeton (31)		
4	Intramuscular	Lipomas
Hunt and Bisgard (14)		
3	Extremities	Lipomas
1	Submental	Lipoma
1	Submaxillary	Lipoma
1	Supraclavicular	Lipoma
1	Chest wall	Lipoma
1	Breast	Lipoma
1	Labium	Lipoma
1	Arm	Collection of petrolatum from pack
Sosman (28)		
1	Intracranial	Lipoma
Windholz (33)		
2	Retroperitoneal	Lipomas
1	Retroperitoneal	Fibromyxoliposarcoma

mass. In every instance, the tumor was deeply situated within the abdominal cavity. Some of these reports are listed in Table III.

It is evident from the foregoing review that fat-containing tumors have heretofore been reported as casting a shadow of diminished density in the following sites,

<sup>1</sup> From the Department of Radiology and Department of Medicine, City Hospital, Winston-Salem, N C. Accepted for publication in September 1947.

TABLE II SUMMARY OF 33 REPORTED VISUALIZED FATTY TUMORS

No	Type Tumor	Location
28	Lipomas	In extremities, 17 Retroperitoneal, 3 Cervical, 3 Abdominal wall, 1 Chest wall, 1 Mammary, 1 In labium, 1 Intracranial, 1
2	Dermoids	Abdominal
1	Fibromyxoliposarcoma	Retroperitoneal
1	Fatty mass	Ventral hernia
1	Petrolatum mass	Arm

in decreasing order of frequency (a) intramuscular (lipomas), (b) retroperitoneal (lipomas, liposarcoma), (c) intraperitoneal (dermoids), (d) intracranial (lipoma)

Lipomas occurring within the mesentery are exceedingly rare, particularly in children. Summers (29) reviewed 128 solid mesenteric tumors and could find only one example of mesenteric lipoma in a child, as compared with 16 other types of solid tumor in this location in children. In 1941, Bass (3) reviewed the literature, finding two previously reported mesenteric lipomas in children. He added a third, occurring in a two-year-old boy. Although roentgen examination showed displacement of the intestines by the mass, no mention was made of the relative density of its roentgen image. Ladd and Gross (16) do not mention the occurrence of mesenteric lipomas in children.

In view of the fact that no previous publication has been found in which a mesenteric lipoma was revealed roentgenographically as a radiolucent mass, and because of the rarity of mesenteric lipomas in children, it is believed that the following presentation is of interest.

#### CASE REPORT

A white girl, aged 4 years, was admitted on August 27, 1945. The mother stated that a mass had been present in the child's abdomen practically since birth. There had been two attacks of nausea and vomiting. The remainder of the history was non-contributory.

The child appeared healthy and the only positive findings on physical examination were referable

TABLE III FATTY TUMORS NOT VISUALIZED AS RADIO- LUCENT SHADOWS ON ROENTGENOGRAM

Author	No	Site
Alton (1)	1	Mesenteric lipoma
Mayo and Dixon (20)	3	Retroperitoneal lipomas
Hunt and Simon (15)	1	Perirenal
	1	Intrarenal
Laurell (18)	1	Retroperitoneal fibrolipoma (3 others visualized, see Table I)
Andrews (2)	1	Retroperitoneal lipoma
Wechsler (32)	1	Retroperitoneal lipoma
d'Abreu (11)	1	Mesenteric lipoma
Blue and Lafferty (5)	1	Perirenal lipoma
Chown (10)	1	Retroperitoneal lipoma (in child 3½ years)
Bass (3)	1	Mesenteric lipoma (in child of 2 years)
Lambrecht (17)	1	Mesenteric lipoma
Regan <i>et al</i> (23)	7	Retroperitoneal lipomas
Bettman and Serby (4)	1	Retroperitoneal lipoma
Masson and Horgan (19)	12	Retroperitoneal lipomas

to the abdomen, where a soft, freely movable mass was noted just below the umbilicus, measuring about 14 cm in diameter. No tenderness was elicited, and the patient seemed to be perfectly comfortable. Routine laboratory findings were negative.

The roentgenographic report was as follows:

#### Fluoroscopy

*Chest* Negative

*Esophagus* Negative

*Stomach* Displaced upward by an extrinsic mass. No intrinsic defects seen.

*Duodenum* Cap and arch normal in outline.

*Six-Hour Examination* Barium present in the lower ileum, all on the right side of the abdomen. A small amount also noted in the jejunum in the left upper quadrant, about 20 per cent gastric residue.

*Radiography* Confirms the fluoroscopic observations. There is a large, poorly defined area occupying most of the abdomen and having a relatively radiolucent appearance. It reaches from the spine posteriorly to the anterior abdominal wall. Mottled calcified deposits are present in the lower anterior portion of the area.

*Diagnosis* Intra-abdominal mass which, in view of its relative radiolucency, is suggestive of a tumor containing a large amount of fatty material. The differential diagnosis includes mesenteric lymphangiomatous cyst or lipoma and, less likely, a dermoid cyst.

On August 31, 1945, *abdominal exploration* was performed by Dr. Howard Starling, whose report is as follows: "An upper right rectus incision was made. A large lipoma the size of a large grapefruit presented itself and was carefully delivered outside the abdominal cavity, and was found to arise from

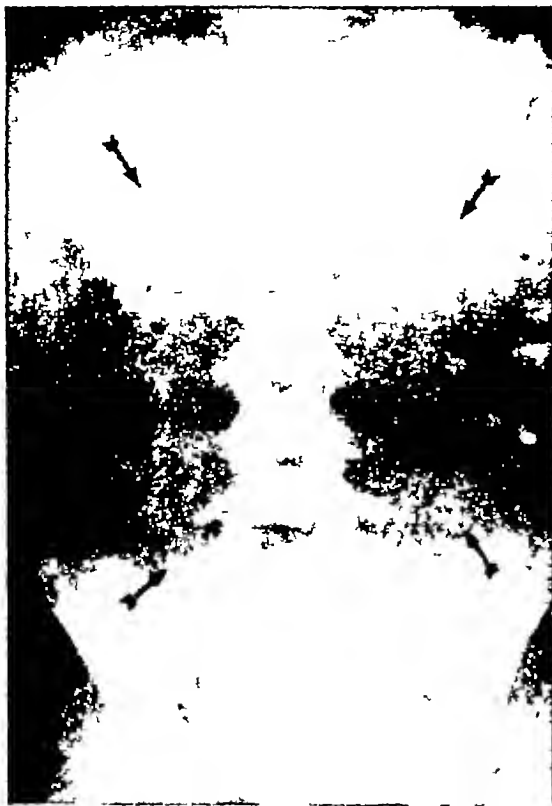


Fig 1 The radiolucent mass is outlined by arrows. Note upward displacement of the barium filled stomach.

the mesentery of the small bowel at a point approximately near the upper ileum. It was removed without difficulty in its entirety. The remainder of the mesentery was sutured."

*Pathologic Report* Mesenteric lipoma, with foci of calcification.

#### COMMENT

The roentgen visualization of adipose tissue is almost entirely dependent on its *contrast*, relative to the surrounding non-fatty tissue. As has already been stated, the roentgen-shadow density of fat is less than that of water (or muscle) and greater than that of air. Therefore, if a mass of fat represented by a lipoma is imbedded in muscle tissue, it will cast a negative shadow relative to that of the adjacent muscle, provided the thickness of the latter is not great enough to reduce the degree of contrast below a critical level. Chasin (9), in an experimental study on cadavers, found that a lipoma in an arm of average thickness (5.5 to 7 cm) must be at

least 2 cm, and in the thigh at least 10 cm, in diameter to be visualized. The degree of contrast can be accentuated by employing a radiographic maneuver first suggested by Laurell (18), the part is submerged in water during roentgen exposure. In routine radiography, it may be recalled that optimum contrast is obtained by using non-screen technic for small parts, screen non-Bucky technic for parts greater than 7 cm in thickness, and screen Bucky technic for parts greater than 11 cm.

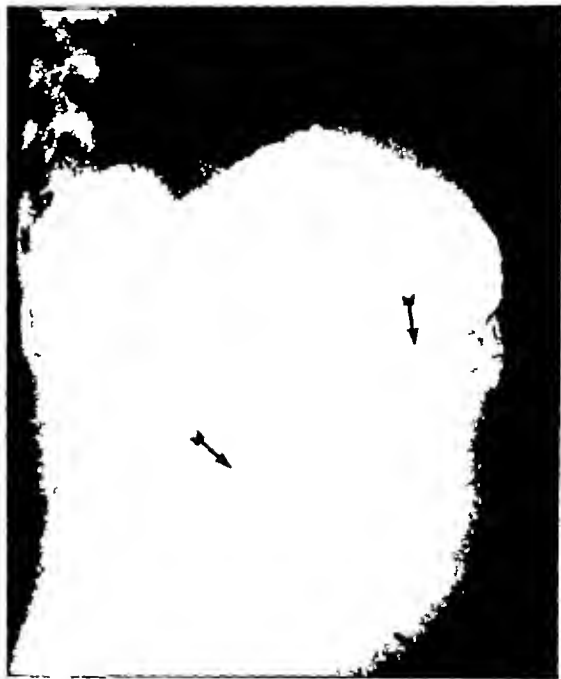


Fig 2 Lateral view showing the extent of the radiolucent mass. The lowest arrow indicates calcified deposits within the tumor.

A corollary to the above principle is that fat will appear denser than air on the roentgenogram, a fact which is borne out by the not infrequent observation of intrathoracic lipomas, which almost invariably show greater density than the lung fields.

It should be borne in mind that admixture of other tissues having a greater content of water will tend to reduce contrast. Thus, a fibrolipoma, if it contains an abundance of fibrous tissue, may even cast a denser shadow than the surrounding structures. Laurell's case of retroperi-

toneal fibrolipoma (18) exemplifies this fact

Since the growth of these tumors frequently outpaces their blood supply, it is not surprising that the larger lipomas show areas of necrosis in which calcium soaps are deposited, producing foci of calcific density in the roentgenogram. This was noted in the case reported here.

The above considerations explain the relative infrequency with which intra-abdominal lipid masses are visualized, as revealed in Table III. Unless there is a favorable balance between the thickness of the trunk muscles and that of the tumor, the latter may not be apparent on the roentgenogram. Technical factors and the degree of contrast in the roentgenogram further complicate the problem. In addition, the tumor must be high in fat content, since a large proportion of fibrous tissue may, by its opacity, overbalance the relative lucency of the fat.

Three factors account for the clear visualization of the tumor presented in this report: the patient was a child, with thin trunk muscles, the tumor was a "pure" lipoma containing practically no fibrous tissue, finally it was large in diameter.

It should be pointed out that differentiation between lipomas and other fatty tumors, such as dermoid cysts, cannot be made on the basis of their radiolucency alone. Both may contain calcific plaques. However, if the tumor contains teeth or identifiable bony structures, it can obviously be classified as a dermoid. Lymphangiomatous or chylous cysts containing a large amount of suspended fat might likewise cast a negative shadow. Clinical data, such as mobility of the mass and displacement of structures, may aid in the differential diagnosis.

It seems reasonable to conclude that one cannot positively differentiate the specific type of fatty tumor on the basis of the roentgenogram alone, but under favorable circumstances, the radiolucent shadow should suggest the presence of a mass containing a high proportion of fat.

## SUMMARY

1 Tumors high in fat content can be visualized by virtue of their radiolucency, which is intermediate between air and water. These include lipoma, liposarcoma, dermoid cyst, and chylous cyst.

2 Fatty tumors containing a large amount of fibrous tissue may not be visualized, or may appear denser than the surrounding tissue.

3 Roentgen visualization, under appropriate conditions, is specific for fatty material, but does not permit of differentiation between the various fat-containing tumors.

4 A mesenteric lipoma is reported in a young child, the fourth such tumor to be reported in early life and the first to be visualized preoperatively, although precise differentiation from other fat-containing tumors could not be made roentgenographically.

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## BIBLIOGRAPHY

- 1 ALTON, B. H. Lipoma of the Mesentery. *Boston M. & S. J.* 185: 205-207, 1921.
- 2 ANDREWS, E. Enormous Retroperitoneal Lipoma. *S. Clin. North America* 11: 105-109, 1931.
- 3 BASS, M. H. Lipoma of the Mesentery in a Child Aged Two Years. *J. Mt. Sinai Hosp.* 7: 298-306, 1941.
- 4 BETTMAN, R. B. AND SERBY, J. Retroperitoneal Lipoma. Report of a Case in Which the Tumor Weighed 22½ Pounds. *Arch. Surg.* 24: 300-307, 1932.
- 5 BLUE, J. H. AND LAFFERTY, C. R. Perirenal Lipoma. *Surgery* 6: 944-946, 1939.
- 6 BROWN, S. AND GROLLMAN, A. An Intramuscular Lipoma. *Radiology* 27: 491, 1936.
- 7 BUFALINI, M. Contribution to the Study of Intramuscular Lipoma of the Arm. *Polichinico (sez. chir.)* 32: 373-381, 1925.
- 8 CAYLOR, H. D. Bizarre Types and Locations of Lipomas. *Am. J. Surg.* 67: 530-535, 1945.
- 9 CHASIN, A. Roentgen Diagnosis of Lipomas and Its Practical Importance. *Röntgenpraxis* 2: 282-287, 1930.
- 10 CHOWN, B. Extrapertoneal Lipoma in a Child. *Am. J. Dis. Child.* 57: 401-403, 1939.
- 11 D'ABREV, F. Case of Lipoma of the Mesentery. *Brit. J. Surg.* 21: 212-214, 1933.
- 12 DYKE, C. In *Diagnostic Roentgenology* (Ross, Golden, Editor). New York: Thomas Nelson & Sons, 1941, pp. 33 F-33 H.
- 13 HOGUE, P. N. Lipomas. *West. J. Surg.* 50: 332-338, 1942.
- 14 HUNT, H. B. AND BISGARD, J. D. Roentgenographic Diagnosis of Lipoma. *Surg. Gynec. & Obst.* 71: 68-71, 1940.
- 15 HUNT, V. C. AND SIMON, H. E. Perirenal and Intrarenal Lipoma. *Am. J. Surg.* 4: 390-395, 1928.
- 16 LADD, W. E. AND GROSS, R. C. Abdominal

Surgery of Infancy and Childhood Philadelphia, W B Saunders & Co, 1941

17 LAMBRECHT, W A Giant Lipoma of the Mesentery Beitr z klin Chir 171 277-282, 1940

18 LAURELL, H On the Roentgen Diagnosis of Fat-Containing Tumors Especially Lipomas, Which are Difficult to Establish Clinically Upsala Läkaref Förh 34 693-708, 1928

19 MASSON, J C, AND HORGAN, E J Retroperitoneal Lipomas Report of 12 Cases S Clin North America 1 1451-1464 1921

20 MAYO C H, AND DIXON C F Retroperitoneal Lipoma Report of 3 Cases Minnesota Med 10 272-276, 1927

21 ODQVIST H Contribution to the Roentgen Diagnosis of Abdominal Tumors Acta radiol 7 253-258, 1926

22 POTTER A H Massive Renal Lipoma Urol & Cutan Rev 40 717-724 1936

23 REGAN, J S, SANES S, AND MACCALLUM, J D So-called Retroperitoneal Lipoma Report of 7 cases Ann Surg 117 110-117, 1943

24 REISS, J On the Roentgen Diagnosis of Deep Lipomas Ztschr f Chir 233 648-653 1931

25 SCHOTTENFELD L E Lipomas of the Gastrointestinal Tract Surgery 14 47-72, 1943

26 SCHÜTZ H Deep Lipomas Deutsche med Wchnschr 52 908-909 1926

27 SILBERMAN, J Roentgen Diagnostic Importance of Adipose Tissue Radiology 32 77-86, 1939

28 SOSMAN, M C Quoted by Dyke (12)

29 SUMMERS, J E Solid Pure Fibroma of the Mesentery in Children Surg, Gynec & Obst 55 244-245 1932

30 TAGLIAVACCHÉ, N Lipomas of Muscles and Radiography Prensa méd argent 19 413-417, 1932

31 TEMPLETON, F E Roentgen Diagnosis of Lipomata Am J Roentgenol 37 210-216, 1937

32 WECHSLER L Retroperitoneal Perirenal Lipoma New England J Med 206 1259-1261, 1932

33 WINDHOLZ, F Roentgen Diagnosis of Retroperitoneal Lipoma Am J Roentgenol 56 594-600 1946

## SUMARIO

### Lipoma Mesentérico en un Niño

### Visualización Roentgenológica

Por ser la grasa traslúcida a los rayos X, lanzando una sombra de densidad intermedia entre el aire y el agua, resulta posible observar radiológicamente los tumores adiposos Sin embargo, cuando un lipoma contiene una gran proporción de tejido fibroso, puede que no sea visualizado o puede aparecer más espeso que el tejido circundante

Si bien la visualización roentgenológica, en condiciones apropiadas, es específica para las materias grasas, no permite de por sí la diferenciación del tipo exacto de tumor lipoma, liposarcoma, quiste dermoideo o quiste quiloso

Repásase la literatura, presentándose una tabla de los tumores de tejido adiposo cuya observación radiológica ha sido comunicada por distintos autores La gran mayoría de los mismos afectaban los miembros Regístrase ahora un caso de lipoma mesentérico en un niño de cuatro años, que según los AA es el cuarto comunicado a una edad temprana y el primero visualizado preoperatoriamente, aunque radiográficamente no pudo hacerse la diferenciación precisa de otros tumores lipóferos El tumor fué extirpado sin dificultad



# Roentgen Diagnosis of Glomus Tumors<sup>1</sup>

WILLIAM H MATHIS, JR, M D, and MILFORD D SCHULZ, M D

Boston, Mass

**T**UMORS OF THE subcutaneous neuro-myioarterial plexus, the glomus body, are uncommon but are by no means as rare as would be indicated by their relatively late recognition as a histopathologic entity. During the past ten years, 18 such tumors have been observed in the Massachusetts General Hospital. During the same period 580,000 patients have been admitted to the hospital service, and 82,000 surgical specimens have been received in the Department of Pathology, which makes an occurrence of one glomus tumor in approximately 32,000 hospital admissions, and one in 4,500 surgical specimens of all types.

The cutaneous neuro-myioarterial glomus is a minute specialized body composed of an afferent arteriole, a tortuous arteriovenous anastomosis (the Sucquet-Hoyer canal), a system of collecting veins, and a neuro-vascular reticulum which regulates the flow of blood through the anastomosis (11). The whole is surrounded by a dense collagenous capsule which separates it from the dermis in which it lies buried about 0.5 mm. It is thought that the function of this body is to serve as a temperature-regulating mechanism, both for the body as a whole and for any individual extremity, by causing the blood flow, in response to certain stimuli to be shunted from the capillary bed by way of the arteriovenous anastomosis (11).

Glomus have been described in the exposed parts of all warm-blooded animals. In man, although distributed quite widely over the body surface, they are normally present in largest numbers in the nail beds, the tips of the palmar surfaces of the digits, the thenar and hypothenar eminences, and the soles of the feet. Authors variously give the number per square centimeter as

ranging from ten to five hundred (11). No glomus are present in the newborn, but they appear in full complement at about five weeks. In advanced age they undergo atrophy. Pathologic changes have been described in glomus bodies in various vascular disorders (11).

Prior to 1924, when recognition of the tumor as a distinct histopathologic entity was publicized by Masson (7), the clinical entity was well known and was referred to by a wide variety of names, the most common of which was "painful subcutaneous tubercle."

Clinically these tumors manifest themselves as painful subcutaneous nodules arising in the various sites of the glomus bodies which, when exposed to cold or trauma, precipitate paroxysms of severe, often incapacitating pain. Grossly they are only a few millimeters in diameter, rarely more than 1.0 cm. They are of a bluish or dusky color and, when situated subungually, as many of them are, they may cause deformity or elevation of the nail. Solitary occurrence is the rule, although multiple lesions have been reported (4, 15).

Glomus tumors are quite often vascular and are characterized histologically by a disorganized overgrowth of the various structures composing the normal glomus. The so-called "glomus cells," which are distinctive cuboidal epithelioid cells derived from the layers surrounding the vascular channels of the normal glomus, are particularly abundant in the tumor growth.

Glomus tumors have been reported at all ages, but occur most commonly in the second, third, and fourth decades. The youngest individual in the group under consideration was sixteen, the oldest, seventy. Of the 18 solitary glomus tumors

<sup>1</sup> From the Department of Radiology, Massachusetts General Hospital, Boston, Mass. Accepted for publication in September 1947.

Surgery of Infancy and Childhood Philadelphia W B Saunders & Co 1941

17 LAMBRECHT W A Giant Lipoma of the Mesentery Beitr z klin Chir 171 277-282 1940

18 LAURELL H On the Roentgen Diagnosis of Fat Containing Tumors Especially Lipomas Which are Difficult to Establish Clinically Upsala Läkaref Förh 34 693-708, 1928

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Repásase la literatura, presentándose una tabla de los tumores de tejido adiposo cuya observación radiológica ha sido comunicada por distintos autores. La gran mayoría de los mismos afectaban los miembros. Regístrase ahora un caso de lipoma mesentérico en un niño de cuatro años, que según los AA es el cuarto comunicado a una edad temprana y el primero visualizado preoperatoriamente, aunque radiográficamente no pudo hacerse la diferenciación precisa de otros tumores lipóferos. El tumor fué extirpado sin dificultad.



TABLE I (Continued)

Hosp No	Age and Sex	Site	Symptoms and Findings	X-Ray	Treatment
R C (120834)	63, M	Knee	Bluish, painful nodules, 5 mm in diameter located in skin on anterior aspect of knee Duration not stated		Excision
E D (309914)	34 F	Foot	Small cutaneous nodule removed at time of abdominal operation No symptoms or duration recorded		Excision
W H M (175430)	70, M	Knee	Small painful cutaneous nodule removed from skin of knee Duration of symptoms not stated		Excision

(see Table I), 15 were found about the distal phalanges of the fingers, 2 about the knee, and 1 on the foot. Other authors have also reported a preponderance of tumors in the fingers, about 33 per cent being subungual. This preponderance presumably is real, but it is possible that, because of the location, a disproportionate number on the extremities are noticed because of pain, while others elsewhere on the body are unrecognized.

Of the 18 tumors, but 6 were in males, and of the 15 about the finger tips, only 4 were in males. A similar sex incidence has been reported by others (10). The overall occurrence of glomus tumors is three times as frequent in females as in males.

#### ROENTGEN FINDINGS

When a glomus tumor of appreciable size lies in such position that it is in contact with bone, especially if it is bound closely to the bone by unyielding surrounding tissues, a pressure erosion defect may appear in the underlying bone. Such a situation obtains when the tumor arises in a digit tip or beneath the nail. Defects in the underlying bone have been reported by various authors (2, 4, 5, 6, 8, 12, 13, 14).

Of the 15 tumors in the present series found in such locations, 9 showed characteristic roentgenologic evidence of erosion of the bone. The typical appearance is that of a smooth, concave deformity in the dorsum or sides of the distal phalanx (Fig 1-A) but there may be a punched-out defect

in the tuft (Fig 1B). The margins of the defect are usually smooth, and while the cortical bone may be eroded, a narrow margin of dense bone is preserved, sometimes the bone underlying the tumor shows eburnation. It has been postulated that the pressure defect in the bone is caused by much the same mechanism as is responsible for bone erosion by an arterial aneurysm.

Glomus tumors should not be confused with other tumors such as enchondromas, which arise within bone rather than extending to involve it from without. An epithelial cyst arising about the finger tip or distal phalanx, however, may produce a defect closely simulating that produced by a glomus tumor (1).

#### DIFFERENTIAL DIAGNOSIS, TREATMENT

Clinically, glomus tumors are confused with fibromas and other cutaneous nodules only when their characteristic hypersensitivity is missing. Of the subungual tumors, neuromas and melanomas may be, but should not be, confused with glomus tumors.

Complete excision of the tumor entirely relieves the pain, for which the patient is most grateful. Although these tumors are benign, they may recur, presumably because of incomplete removal. In the group reported, there were two recurrences. Treatment by x-radiation is mentioned only to be advised against. In two instances, where this treatment is reported

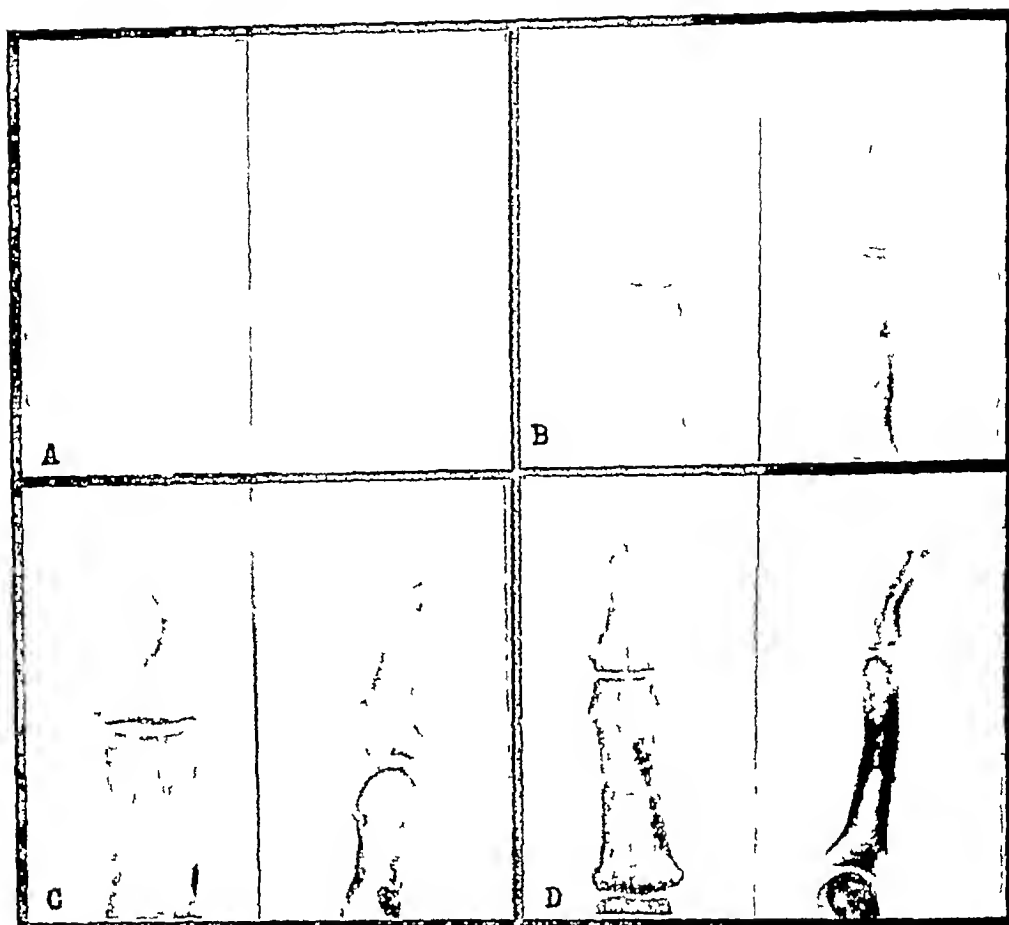


Fig 1 A The tumor causes a smooth concave defect on the medial surface of the distal phalanx with slight thickening of the underlying cortex  
 B A tumor on the tip of the finger causes a smooth punched-out defect in the tip of the tuft of the terminal phalanx. A thin sclerotic margin is preserved  
 C Tumor on the medial aspect of the fingertip causes a large sharply defined defect in the bone  
 D Subungual tumor producing concave deformity of the dorsum of the distal phalanx

to have been administered in error, it was found to be ineffective (3, 9)

#### SUMMARY AND CONCLUSION

1 Glomus tumors, although uncommon, are not as rare as one might be led to believe by their relatively late recognition as a histopathologic entity

2 They are extremely painful tumors arising from normal glomus bodies, most commonly appearing about the digit tips, and occurring in the female four times as often as in the male

3 When the tumor is located about the finger tip and produces a bony defect, its presence may be postulated on the basis of

the characteristic roentgenographic findings

4 Glomus tumors are benign, and simple excision effects a cure

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#### REFERENCES

- 1 BISSEIL A D, AND BRUNSCHWIG, A Squamous Epithelial Bone Cysts of Terminal Phalanx and Benign Subungual Squamous Epithelial Tumor of Finger J A M A 108 1702-1704, May 15, 1937
- 2 CHANDLER, L R Subcutaneous Glomus Tumor California & West Med 47 156-158 September 1947
- 3 FOWLKES R W, AND PEEPLE A W Tumors of Glomus (Glomangiomas or Angiomyoneuromas) South M J 33 269-274, March 1940

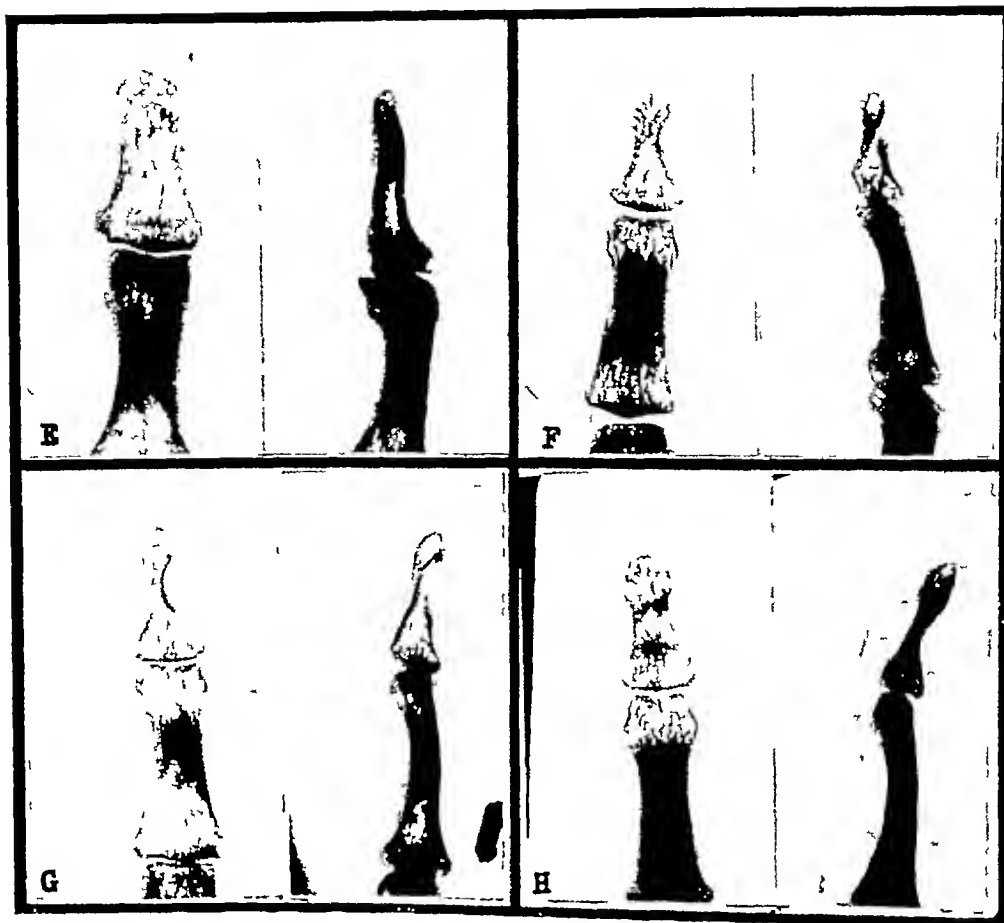


Fig 1 E Subungual tumor producing concave deformity of the dorsum of the distal phalanx  
 F Subungual tumor producing erosion on the dorsum and medial aspects of the phalanx and base of the tuft  
 G Subungual tumor producing smooth concave pressure defect on the dorsum and lateral aspects of the phalanx, with some condensation of the underlying cortex  
 H Subungual tumor producing pressure defect on the dorsum of the phalanx with eburnation of the thinned underlying shaft and loss of trabecular structure

4 HUMPHREY A A, AND BRAINARD C W Subungual Glomus Tumors Report of Two Cases Internat S Digest 24 259-264, November 1937

5 LEWIS, D AND GESCHICKTER C F Glomus Tumors (Arterial Angioneuromyoma of Masson) J A M A 105 775-778 Sept 7 1935

6 MASON M L, AND WEIL A Tumor of Subcutaneous Glomus, Tumeur glomique, Tumeur du glomus neuromyo artériel, Subcutaneous Painful Tubercle, Angio myo neurome Subcutaneous Glomal Tumor Surg Gynec & Obst 58 807-816 May 1934

7 MASSON P Le glomus neuromyo artériel des régions tactiles et ses tumeurs Lyon chir 21 257-280 May-June 1924

8 MEYERS M P Glomus Tumor Report of 4 Cases J Michigan M Soc 38 204-208 March 1939

9 MUELLER S C Subungual Glomus Tumor Minnesota Med 22 708 October 1939

10 OTTLEY C M Glomus Tumour Brit J Surg 29 387-391, April 1942

11 POPOFF N W The Digital Vascular System, with Reference to State of Glomus in Inflammation Arteriosclerotic Gangrene, Diabetic Gangrene Thrombo-Angitis Obliterans and Supernumerary Digits in Man Arch Path 18 295-330 September 1934

12 RAISMAN V, AND MAYER L Tumor of the Neuromyoarterial Glomus Report of Cases Arch Surg 30 911-929, June 1935

13 RYPINS, E L Roentgenologic Aspects of Subungual Glomus Tumor Am J Roentgenol 46 667-672 November 1941

14 LÜDIN M Knochenveränderung (Druck-usur) durch Tumor des neuromyoarteriellen Glomus Röntgenpraxis 8 375-376, June 1936

15 WEIDMAN, F D, AND WISE, F Multiple Glomus Tumors of the Order of Telangiectases Arch Dermat & Syph 35 414-426 March 1937

*Spanish summary on following page*

## SUMARIO

## Diagnóstico Roentgenológico de los Tumores Glómicos

Los glomos o tumores glómicos son neoplasias por demás dolorosas derivadas de los cuerpos glómicos normales que se asientan generalmente en los extremos de los dedos. Si están situados de modo que queden en contacto con el hueso, y máxime si se hallan fijos al último por tejidos circundantes inflexibles, pueden provocar una típica deformación debida a la erosión ocasionada por la compresión y que puede reconocer la radiografía. El típico aspecto

es de una deformidad cóncava y lisa en el dorso o lados de la falange distal, pero puede haber también un nicho excavado en el glomérulo. Los bordes de la cavidad suelen ser lisos, y aunque puede hallarse excavado el hueso cortical, se conserva un borde estrecho de hueso espeso. A veces el hueso subyacente revela eburnación. Los tumores son benignos, y la simple excisión efectúa la curación. Comuníquese una serie de 18 casos.



# Compression of the Spinal Cord Caused by Hodgkin's Disease

## Case Reports and Treatment<sup>1</sup>

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HODGKIN'S DISEASE may involve any of the structures of the body. Of special interest is its presence in the spinal canal, even though this is an infrequent complication. When such involvement is suspected, an immediate decision must be made as to the nature of treatment. Four alternatives present themselves: radiation therapy, neurosurgical intervention, a combination of these two, and neglect. At the University of Minnesota Hospitals 11 cases of spinal cord compression caused by Hodgkin's disease (8 proved, 3 clinical) were observed during the period 1926-47. Experiences with the treatment of these cases will be detailed.

Weil (18), in 1931, reviewed the world's literature and recorded 43 cases of central nervous system involvement secondary to Hodgkin's disease; he added 3 cases observed personally. Of the 46 patients, 40 had epidural masses, with or without involvement of the vertebrae, 2 had infectious myelitis, 2 had syringomyelia, and 2 had cerebral lesions. All of these cases were confirmed by autopsy or operation. Only 3 patients received x-ray therapy for the spinal involvement, and all 46 died within six to twelve months after onset of symptoms. Since Weil's review, isolated case reports have appeared. Cooper (2), Keschner (10), and others (9, 11, 16, 19, 20) have each added one proved case of Hodgkin's disease in the epidural space, and Rosh (14) has added two instances of compression of the spine with vertebral collapse. In 1941, Gray *et al* (8) described 3 cases of proved involvement. These were observed at the University of Minnesota Hospitals and are brought up to date in the present study (Cases 2, 3, and 4 in our series).

Four mechanisms have been invoked to explain the presence of spinal cord symptoms, by Weil (18), Allen and Mercer (1), Weber (17) and others (2, 8). These are as follows:

(a) Epidural deposits of Hodgkin's tissue extending from involved cervical, mediastino-bronchial, or retroperitoneal lymph nodes, by way of the lymph channels of the nerve roots, into the epidural space. The dura is supposedly effective in blocking further invasion.

(b) Destruction of the bodies of vertebrae with collapse and direct mechanical compression of the spinal cord, or spread from the diseased spine epidurally.

(c) Mechanical compression of the blood vessels within the intervertebral foramina or just outside of the spinal cord, causing impaired circulation to the cord—myelomalacia.

(d) Rarely, degenerative or inflammatory changes within the cord, such as syringomyelia or myelitis, with or without epidural masses.

Winkelman (20) attributed the presence of epidural masses in some cases to vascular metastases.

## CASE REPORTS

The following factors, unless otherwise specified, were used for deep x-ray treatments in the cases here reported: 200 kv, 30 ma (or 220 kv, 15 ma), 1.0 mm Cu and Al filtration (half-value layer 1.7 mm Cu), and 60 or 70 cm target-skin distance. All microscopic reports are from the Department of Pathology, under the direction of Dr. E. T. Bell.

Case 1. C. S., a 43-year-old male, was studied in the outpatient department in 1932, and a clinical diagnosis of Hodgkin's disease was made on the basis

<sup>1</sup> From the Department of Radiology and Physical Therapy of the University of Minnesota and the University Hospitals, Minneapolis, Minn. Accepted for publication in August 1947.

of axillary, supraclavicular, and inguinal nodes of one year duration. Biopsy revealed lymphadenitis, no x-ray treatments were given.

The patient was admitted to the hospital in March 1935, because of sudden paralysis of the lower extremities of about two weeks duration. He was unable to control the bowel and bladder sphincters.

Physical examination revealed cervical, axillary, inguinal and retroperitoneal masses, and an enlarged spleen. There was spastic paralysis of both legs with hyperactive reflexes in the lower extremities. The toe signs were positive bilaterally, there was knee and ankle clonus and the abdominal and cremaster reflexes were absent. There was diminished sensation below the nipple line, pain, temperature, and light touch were absent below the fourth thoracic segment. The patient complained of pain radiating around the body just above the nipples, particularly on the right side.

On April 3, 1935, biopsy of one of the axillary nodes was reported as showing Hodgkin's disease. Deep x-ray therapy was started on April 4, 1935, five treatments being given in four days to one field centered over the 5th thoracic vertebra. An area of about  $9 \times 18$  cm was used, 1,500 r/air were given. Myelography, on April 10, revealed a complete block at the 1st thoracic segment, and a laminectomy was done the same day in the upper thoracic region. Tumor was seen beginning at the level of about the last cervical segment and extending to about the 3d thoracic segment. The dura was infiltrated, friable, and reddened. A biopsy was taken and 19.7 mc of radon were implanted—10 seeds on each side of the mass at about 1–1.6 cm from the cord and 2 seeds on the posterior side of the cord at the site of greatest thickening.

The postoperative course was uneventful. At the time of discharge from the hospital, May 1, 1935, the patient had some restoration of bladder function and return of motion of the lower extremities. He died at another hospital one month later, no autopsy was performed.

**CASE 2** M F, a 28-year-old female, was first seen in January 1930, because of enlarged cervical and mediastinal nodes. Biopsy of a neck node showed Hodgkin's disease. Deep x-ray therapy was given to both areas, and in April 1935 to abdominal masses. In October 1935, herpes zoster of the left 8th intercostal nerve developed. In September 1936, the patient underwent laparotomy for removal of a left ovarian cyst and subtotal hysterectomy. She suffered some severe right lower quadrant pain after discharge from the hospital, and was readmitted, Oct 14, 1936, because of persistence of this pain and pain in the right lumbar region. There was some constipation and two episodes of vomiting occurred. While the patient was being observed, numbness developed in the right leg, progressing in five days to a complete flaccid paralysis, the left lower extremity was paretic. Knee and ankle jerks were absent bilaterally, the toe signs were negative. There was

decreased sensation to pinprick and cotton below T-12. Deep sense was intact. There was tenderness over T-10. Roentgenograms of the spine were negative.

Laminectomy in the lower thoracic region was performed on Oct 27, 1936. An epidural mass extending from T-8 to beyond T-12 was found. As much of the tumor was removed as possible. Deep x-ray therapy was begun on Nov 6, 1936, four treatments being given in eight days. A total dose of 1,500 r/air was given through three  $10 \times 20$  cm ports, a direct posterior and two oblique posteriors. Microscopic examination of the removed tissue showed "extremely cellular" Hodgkin's disease.

The postoperative course was uneventful and the patient regained complete use of her legs. When seen seven months later—April 1937—she had some residual weakness of the right foot, with absent reflexes, though the limb functioned well.

Deep x-ray therapy was again given for mediastinal masses in 1938 and was repeated when these recurred in 1940. At about that time a refractory anemia developed. Death occurred in October 1940. The situation at death is unknown.

**CASE 3** H T, a 29-year-old male, was first seen in May 1934, at which time a clinical diagnosis of Hodgkin's disease was made on the basis of enlarged cervical lymph nodes, pruritus, weight loss, and weakness. Deep x-ray therapy was given to the cervical nodes. In May 1936, enlarged mediastinal nodes were irradiated.

In October 1936, the patient was admitted to another hospital. The findings reported there were muscular weakness of both arms and legs, atrophy of left hand and arm, Horner's syndrome, absence of abdominal reflexes, pyramidal tract signs marked on right, a sensory level for pain and temperature present at about the first or second rib and for touch at about the umbilicus. A diagnosis of compression of the spinal cord in the lower cervical region was made, and four x-ray treatments were given, with "some improvement."

The patient was admitted to the University Hospitals on Feb 17, 1937, with paralysis below the cervical segments. Severe dyspnea and mental confusion were present. The extremities were atrophic. There were moderate left ptosis and miosis. The deep reflexes were feeble. Deep muscle and joint sense were absent below the upper chest. Two large nodes were present in the left side of the neck. The temperature rose to  $108^{\circ}$  and death ensued two days after admission.

At necropsy, masses of nodes were found in the lower part of neck, bilaterally. A large mass completely filled the lower part of the neck and upper third of the mediastinum, with infiltration into the apical portions of the lungs. Large areas of yellowish necrosis were present in these masses. The lower cervical and upper thoracic sections of the spinal cord were surrounded by a large epidural infiltration 10 cm in length. The rootlets emerged directly through the tumor tissue surrounding the cord. The

subdural space in this region was completely obliterated. Microscopically there were vacuolization and fragmentation of the anterior portion of the dorsal funiculus and posterior portion of the lateral columns. Sections through the epidural mass and the mediastinal and cervical masses revealed typical Hodgkin's disease with much necrosis, fibrosis, and cellular areas.

CASE 4 K K, a 29-year-old-male, was admitted to the University Hospitals on Jan 16, 1937. Eight months previously he had a gnawing pain under his right shoulder blade, which disappeared in about four weeks. Seven months previously, he had noted the onset of severe, stabbing, constant pain in the small of the back, aggravated by movement, particularly by bending backwards. This had been diagnosed as rheumatism, and 3 or 4 injections of serum were given, with some relief. Six months prior to admission, an upper respiratory infection developed, with chest pain and cough. Five months previously, numbness in both great toes and weakness of the lower extremities were noted. Three months previously, there was some difficulty with the knees and the patient began to lose weight. Two months previously, a pleural effusion developed and 160 c c of fluid were removed at another hospital. A movable mass was felt in the abdomen. There was a band of anesthesia at T-4, lumbar puncture revealed a block. X-ray examination of the chest showed a widened mediastinum. The patient was transferred to this hospital for deep x-ray therapy.

Physical findings at admission were dullness and diminished breath sounds and fremitus at the base of the right lung. An abdominal mass about 5 X 8 cm was palpable in the mid-line below the umbilicus. Neurologic examination revealed impaired sensation below T-4 or 5 anteriorly and T-6 posteriorly. There was weakness of both lower extremities. The knee jerks were hyperactive. The Babinski and Romberg signs were negative and the abdominal reflexes were absent. Muscle tone was decreased and walking was difficult.

Lumbar puncture on Jan 18, 1937, showed a blocked subarachnoid space. Lipiodol was injected into the spinal canal on Jan 19, 1937, and an obstruction at about T-3 or T-4 was demonstrated. On Jan 22, laminectomy was done, and a firm, nodular extradural tumor was found extending from C-7 to T-4 or T-5. Part of the tumor was removed. The histologic appearance was that of typical Hodgkin's disease: necrosis, Dorothy Reed cells, and lymphoid infiltration.

Deep x-ray therapy to the chest and spine was begun on Jan 27, 1937. Anterior and posterior fields, approximately 20 X 27 cm were used, eight treatments were given in fourteen days, 1000 r/air being given to each field.

The patient recovered completely. All numbness, weakness and loss of sensation disappeared during the next six weeks. He has subsequently had fourteen courses of deep x-ray therapy to other areas of

involvement by Hodgkin's disease, but there has been no recurrence of spinal involvement. The survival is ten years and six months since the original treatment. The patient was last seen in June 1947.

CASE 5 T L, a 28 year-old male, was admitted on May 18, 1942, with sharp, constant pain in the back of the left lower chest, radiating anteriorly, first noticed following a cold the previous month. The pain was aggravated by sneezing and motion, but not by deep respiration. The only positive findings on physical examination were definite tenderness posteriorly over T-6 and hyperesthesia corresponding to the distribution of T-5 or T-6. X-ray examination of the thoracic spine revealed destruction of the pedicle of T-6. The patient had a slight fever, elevated sedimentation rate and white count, and was mentally retarded.

On May 15, 1942, laminectomy of T-6 was done. The entire area of subcutaneous tissue and paravertebral muscle was very vascular. Most of the spinous process and lamina bilaterally were destroyed and replaced by a friable necrotic mass about 3 cm in diameter, which surrounded and invaded the dura. The lamina of the spines above and below were intact. The left posterior 6th root was sectioned because it was involved. Most of the tumor was curetted away to decompress the cord after the 5th and 7th laminae were removed on each side of the defect in the spine.

Microscopic examination showed Hodgkin's disease (necrosis, scar tissue, Dorothy Reed cells, and eosinophils), and x-ray therapy was begun on July 6, 1942. Posterior and left and right posterior oblique fields were used, encompassing T-4 to T-8, 900 r/air were delivered to each field. Nine treatments were given in ten days.

Pain subsided postoperatively, and the patient made an uneventful recovery. During the next four years, he received deep x-ray therapy for Hodgkin's disease in the mediastinal, axillary, inguinal, cervical, and other regions. About April 1946, his hemoglobin dropped despite transfusions, and he died on May 28, 1946. No autopsy was obtained. There was never any indication of recurrence of the paraplegia. The period of survival from the time of laminectomy to death was three years and eleven months.

CASE 6 L B, a 16-year-old male, admitted on March 13, 1947, had Hodgkin's disease, diagnosed three years previously on the basis of biopsy of a cervical node. He had received deep x-ray therapy to the neck in 1943 and axilla in 1945.

About the middle of February 1947, he began to have pain in the calves of both legs, this continued to the time of admission. Four days prior to admission, marked weakness of both legs developed, and this had remained about the same. Physical examination revealed an area of saddle anesthesia. Reflexes in the lower extremities were absent, there were no sensory changes. The cremaster reflexes and abdominal rectus reflexes were intact. The im-

pression was that the patient had Hodgkin's involvement of the cauda equina. A spinogram, obtained with pantopaque, showed a complete block in the region of the 3rd lumbar vertebra.

On the night of admission, March 13, a bilateral laminectomy of the lower four lumbar vertebrae was performed. An extradural tumor,  $5 \times 0.75$  cm, was seen. Complete decompression of the cauda equina was accomplished by laminectomy and partial removal of the tumor. Hodgkin's disease was proved by microscopic examination.

The postoperative course was uneventful. Deep x-ray therapy to the lumbar spine was begun on the day after surgery. Four fields, approximately  $11 \times 16$  cm, were used: anterior, posterior, and left and right posterior obliques. Each field received 1,200 r/air, sixteen treatments were given in twenty-one days.

In May 19, 1947, the patient was walking with the aid of Canadian crutches and was in good conditions.

**CASE 7.** A W, a 41-year-old male, was admitted on April 27, 1946. In May 1945, he had noticed rapid enlargement of the cervical and axillary nodes, associated with increasing dyspnea and a 20-pound weight loss. A diagnosis of Hodgkin's disease was established at another hospital, and deep x-ray therapy was given to the neck, axilla, and mediastinum, with a remission of signs and symptoms. In December 1945, there had been some pain in the left arm and shoulder, radiating to the thumb and first finger. This disappeared spontaneously in three weeks and was followed by sharp right-sided low back pain radiating about the flank to the lower abdomen (along the course of T-9). Three weeks before admission there was pain in both hip joints, radiating down the anterior aspect of both thighs, more severe on the right. A week later, the patient was unable to urinate or defecate spontaneously.

Physical examination revealed paralysis of all of the muscles of the thighs and legs, and weakness of the abdominal muscles, especially on the right. There was slight weakness of the left triceps, biceps and deltoid. All reflexes in the lower limbs were absent. There was complete anesthesia of the lower extremities below T-12 or L-1. X-ray examination of the spine showed invasion of the body and laminae of the 11th and 12th thoracic vertebra and destruction of the 11th and 12th ribs on the right; chest films showed infiltration of the lungs.

On April 29, 1946, laminectomy of T-10 to T-12 was performed. Tumor tissue was seen extending from the right side laterally to the vertebrae, with extension through the intervertebral foramen and into the spinal canal. The tumor had pushed the dural sac and its contents to the left over an area of two vertebrae. Most of the tumor tissue was removed.

Deep x-ray therapy was begun on May 3, 1946. Nine treatments were given in thirteen days covering the area D-8 to L-2, through three portals—pos-

terior and left and right posterior obliques—900 r/air being given to each.

The removed tumor was a large, partially necrotic mass. The intact areas showed round and oval tumor cells, arranged in sheets. The appearance suggested a malignant lymphoblastoma or reticulum-cell sarcoma.

Soon after operation, the patient regained function of his lower extremities, but continued to be incontinent of urine. After four months, however, he had also regained control of his bladder and bowels.

**CASE 8.** J D, a 16-year-old male, was admitted to the University Hospitals on Sept 10, 1946. He had suffered from occasional sharp backache and aching of both lower extremities for about four months. One month previously neck pain had developed and two weeks before admission he had complained of a peculiar feeling in both lower extremities. Following this, his legs became progressively weak and stiff. He was admitted to another hospital, where a diagnosis of spastic paraplegia was made and he was then transferred here.

Examination was negative except for the presence of moderately enlarged, discrete, non-tender lymph nodes in the anterior cervical triangles, and for the neurologic findings. There was loss of all modality of sensation below the 5th thoracic level. All the deep reflexes in the lower extremities were hyperactive, with ankle clonus and positive toe signs bilaterally. The abdominal reflexes were absent. X-ray examination of the chest revealed considerable widening of the upper mediastinum. The thoracic spine showed erosion of pedicles of T-3 to T-5. A spinal puncture showed a spinal arachnoid block. The fluid was xanthochromic, containing 14 mononuclear cells, sugar 34 mg per cent, and proteins 685 mg per cent; the Nonne reaction was positive. The blood count and urine examination were within normal limits. The clinical diagnosis was a spinal cord tumor at T-4, probably a neurofibroma anterior to the cord.

On Sept 12, 1946, a bilateral laminectomy of the first four thoracic vertebrae was performed. A yellow extradural tumor of tough consistency was seen to overlie the entire dorsal aspect of the left lateral region of the visualized spinal cord, protruding out between the lamina. The tumor was resected subtotally. The dura was not involved, and pulsated normally after the decompression. Microscopic examination revealed typical Hodgkin's disease: considerable fibrosis, numerous lymphoid cells, eosinophils, and large reticular cells of the Dorothy Reed type.

Deep x-ray therapy was instituted on Sept 17, 1946, 1600 r/air were given to the posterior upper thoracic spine through one field approximately  $11 \times 23$  cm, eight treatments being given in ten days.

Convalescence was uneventful, and the patient gradually recovered sensory powers in the lower extremities, as well as motion of the toes and knees.

Three months later he still had considerable weakness but was walking without a cane

He was seen again on June 19, 1947, when he had enlargement of the nodes in the left anterior cervical triangle and x-ray therapy was begun to that area. He was performing farm labor without complaints, and had no neurologic residua

**CASE 9** J K, a 26 year-old female, was first seen in July 1926, because of a left supraclavicular mass of one month duration. A diagnosis of Hodgkin's disease was made at that time. Deep x-ray therapy was begun on July 28, 1926, and the mass diminished remarkably in size

In January 1927, information was received that in the previous month the patient had become paralyzed from the hips down. She was persuaded to enter the hospital, and was found to be markedly emaciated with massive retroperitoneal nodes. X-ray treatments were begun, 600 r/air being given to the upper dorsal spine in two treatments in three days. The treatment had to be discontinued, however, because of the patient's poor condition. She died the following month

**CASE 10** L P, a 26 year-old male, was first seen in the outpatient department in April 1936, complaining of generalized lymph node enlargement, dyspnea, and loss of strength. He gave a history of an episode of cervical adenopathy six years previously. Biopsy of an axillary node revealed Hodgkin's disease. Deep x-ray was given in May 1936, to the nodes of the neck, axilla, and inguinal region, the spleen, and an ulcer on the buttocks

Shortly after the last x-ray treatment, sharp pain occurred low in the back, accentuated by weight bearing. The pain increased in severity and walking became difficult. X-ray examination of the spine revealed a pathological compression fracture of T-12. Weight extension was applied to the lower extremity for two and a half weeks and a body cast was then applied. Three deep x-ray treatments, totaling 1,150 r/air, were given to the fractured area through a posterior and two posterior oblique fields, in seven days. The cast was removed and a brace applied in October 1936

In February and March 1937, x-ray treatment was given to both axillae, retroperitoneal nodes, and both sides of the neck

In August 1937, the patient was again seen because of paralysis of the left lower limb and a marked paresis of the right lower limb, with impaired sensation up to T-6 and complete loss below T-9. X-ray examination showed the 5th and 8th thoracic vertebrae to be crushed. It was felt that laminectomy would be valueless because of the compression fractures. A course of deep x-ray therapy was given to the posterior thoracic region beginning on Aug 3, 1937. Posterior and right and left posterior oblique fields were used, 600 r/air being given to each field in thirteen days. The patient was then put on a Bradford frame, with considerable improvement. Sensation returned to normal except for a region near the

right groin. Motor power was partially restored to both lower extremities

In two months the patient was walking fairly well and felt much improved. Sensory perception improved, and by January 1938, he was markedly better, though still requiring a brace for walking

In November 1937, treatment was given to the chest for an infiltration from the hilar region out into the left lung. Later a massive pleural effusion developed on the left. Death occurred Feb 11, 1938, without recurrence of spinal symptoms

**CASE 11** L E, a 17-year old male, had become ill in August 1942, with enlargement of the cervical and axillary nodes, a weight loss of 35 pounds, fever, anorexia, and weakness. A node was removed and reported as Hodgkin's disease. There was a leukocytosis of 25,000 to 50,000, the differential count revealed a toxic neutrophilia, with 80-90 per cent toxic neutrophils. This was considered to be the result of necrosis within the enlarged nodes. Transfusions were given, and deep x-ray therapy to the involved areas. In January 1943, some inguinal nodes were irradiated

At the end of January 1943, severe, sharp pain in the posterior aspect of the left thigh and lumbar region developed. Shortly thereafter there was weakness, then paralysis, in the lower limbs. The white cell count was 16,900, hemoglobin 7.0 gm. Roentgenograms revealed a destructive process in the body of the first lumbar vertebra and in the left sacroiliac joint. The clinical impression was an epidural infiltration compressing the cauda equina in the lumbar region

Deep x-ray therapy to the lumbar spine had been instituted on Jan 26, 1943, via an anterior and posterior port. Each field received 1,200 r/air, eight treatments being given in fifteen days. The factors were 400 kv, 5 ma, Thoraeus filter, 14 X 18 cm field, 80 cm distance

Immediately after the deep therapy was begun, the patient's paralysis seemed to become worse, however, there was improvement toward the end of the course of treatment. Examination on Feb 15, 1943, revealed a paresis of all limbs, with almost complete paralysis of the legs. The reflexes were hyperactive, and positive toe signs were present. There was no marked remission, and death occurred on April 3, 1943. Neurosurgery was not performed in this case because of the poor general condition of the patient. In retrospect, it was believed that surgery should have been attempted, despite this, and deep x-ray therapy instituted thereafter

#### COMMENT

In two small series of cases, the incidence of spinal involvement has been reported as 5 in 36 cases of Hodgkin's disease (6) and 2 in 14 cases (15). Between 1926 and 1947, 305 cases of Hodgkin's disease were treated by the Radiation Therapy Depart-

ment of the University of Minnesota Hospitals, 11 of the patients undoubtedly had spinal cord compression, an incidence of 3.6 per cent. Nine of the 11 patients were male. The age range was from sixteen to forty-three years, the average was twenty-seven years.

Pain in the back, usually of a sharp, lancinating character, was the earliest complaint of 7 of the patients. The pain usually had a radicular distribution. Paresis and paralysis of the extremities developed after varying periods of time, in one case within two weeks of the time of onset of pain. Bladder and bowel incontinence were usually present at this time. Characteristic neurologic findings were observed on physical examination—flaccid or spastic paraplegia, with a loss of sensation below the level of segmental involvement. In one case there was point tenderness over an involved vertebra. X-ray study of the spine revealed bone changes in 5 cases, and myelography with pantopaque or lipiodol localized the spinal block in 3 cases.

The treatment consisted of laminectomy performed as an emergency procedure when an acute intraspinal compression was apparent, *i.e.*, when, in addition to pain, paresis had developed. The surgery was performed by members of the neurosurgery service, under the direction of Dr. W. T. Peyton. X-ray therapy was used concomitantly. With the newer technic, 1,200 r/air was given to each of three fields: one posterior, centered over the involved spinal segment, and two posterior oblique, overlapping the first field. An additional anterior field has been used occasionally. Treatment was given in doses of 200–300 r/air daily, for about three weeks. The factors were 220 kv, 60 or 70 cm. focal skin distance, 1 mm. Cu and 1 mm. Al filters, with a half-value layer of 1.7 mm. Cu. When a compression fracture was present, orthopedic management was employed.

Laminectomy was performed in 7 of the 11 cases, thus verifying the diagnosis. One of these, Case 7, was in the lymphoblastoma group, but the exact pathologic diagnosis was obscure. In 3 cases, the

diagnosis was made clinically, in 1 it was confirmed by autopsy. The sites of involvement were the lower cervical and upper thoracic cord in 5 cases, the lower thoracic cord in 4, and the lumbar spinal cord in 2. Eight of the patients had verified epidural masses, in all of this group cervical, mediastinal, or retroperitoneal nodes were present at or about the time of appearance of the compression paraplegia. In two cases the spread to the spinal canal was established, at the time of laminectomy, to be by way of the intervertebral foramina. Presumably it was similar in the others. In 3 cases, the dura was invaded by the disease. X-ray examination revealed destruction of the lamina and body of a thoracic vertebra in 1 case, in two there was invasion of the pedicles, and 2 had the appearance of invasion of the body of a thoracic vertebra. There was only one case of compression fracture or collapsed vertebra. In no case was there any indication of inflammatory or degenerative changes as the primary cause of the symptoms.

Four of the 11 patients are still alive ten years and six months, one year and two months, nine months, and two months, respectively, from the time of treatment. The one with the longest survival has made a complete clinical neurologic recovery, the other three have had startling clinical improvement, but there are still some residual neurologic changes. Two other patients lived for approximately four years after treatment and recovered from their paraplegias, although they succumbed to Hodgkin's disease localized elsewhere in the body. Of the 5 patients who died earlier, the phrase "too little and too late" may be applied to the treatment received. Had x-ray therapy been given more vigorously in Cases 3 and 8, earlier in Case 1, and had a laminectomy been performed in Case 10, the results might perhaps have been different.

#### DISCUSSION

The diagnosis of spinal cord compression during the course of Hodgkin's disease is

not difficult to make. The presence of mediastinal widening or enlarged lymph nodes in a patient whose presenting symptoms and signs are those of cord compression should lead one to suspect lymphoblastomatous involvement of the central nervous system. Herpes zoster during the course of Hodgkin's disease has been reported as an indication for prophylactic high-voltage therapy to prevent paraplegia (7). There were 6 cases of herpes zoster in our total series of 305 cases, only one of these patients developed paraplegia, and that was one year later (Case 2).

The object of treatment is to prevent paraplegia, or if this is already present, to relieve it. Prophylaxis is very important. We believe that early intensive x-ray therapy in the "pain stage" can prevent the occurrence of a paraplegia. In the total series of 305 cases, quite a few patients had episodes of back pain, and were given courses of deep x-ray therapy on the basis of verified or unverified lymph node or bone involvement, in these patients neurologic signs did not develop. The cases are not included here because they remained unconfirmed, both clinically and pathologically. Viets and Hunter (16) and Ginsburg (6) have reported cases in which early diagnosis and x-ray treatment caused disappearance of impending paraplegic symptomatology.

When compression symptoms are more severe—when the disease has progressed to weakness of the extremities and neurologic findings are present—immediate laminectomy should be performed, with the removal of as much involved tissue as possible. This should be followed by immediate x-ray therapy. We have begun treatment as early as the first postoperative day without evidence of interference with wound healing.

Dyke and Davidoff (3) observed that in late cases, when spinal cord compression has existed for some time, radiation therapy produces only temporary improvement. In our cases of late treatment, we observed no beneficial effects, death supervening rather promptly.

Goldman (7) in one case and Weil (18) in three cases reported that x-ray therapy caused resolution of the lymphogranulomatous epidural masses, but also produced residual scarring and fibrosis, which caused compression of the spinal cord. We have not encountered this complication. Furthermore, it has been stated (8) that most epidural masses consist of fibrous Hodgkin's tissue which is resistant to radiation, since there is very little cellular material present. In our cases, microscopic examination revealed typical Hodgkin's disease with no particular prominence of any one of the features of this disease, but with all of them present in different sections of the same mass. From a practical point of view, it is not unreasonable to conclude that at least six of the epidural masses reported in this paper were radiosensitive, since good clinical results were obtained.

#### CONCLUSIONS AND SUMMARY

1. Eleven cases of spinal cord compression due to Hodgkin's disease are presented. The presence of an epidural mass was confirmed in 8 cases by operation or autopsy.

2. When the diagnosis of impending spinal compression is made, adequate radiation therapy should be instituted at once.

3. When spinal compression exists, the treatment of choice should be immediate laminectomy followed by intensive deep x-ray treatment.

4. Six of the 11 patients had satisfactory clinical and neurologic remissions.

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#### REFERENCES

1. ALLEN, I. M. AND MERCER, J. O. Spinal Symptoms with Lymphadenoma. *J. Neurol. & Psychopath.* 17: 1-15, July 1936.
2. COOPER, M. J. Lymphogranulomatosis Maligna (Hodgkin's Disease) with Invasion of the Spinal Canal and Paraplegia. *J. A. M. A.* 102: 917-921, March 24, 1934.
3. DYKE, C. G., AND DAVIDOFF, L. M. Roentgen Treatment of Diseases of the Nervous System. Philadelphia: Lea & Febiger, 1942.
4. EAST, C. F. T. AND LIGHTWOOD, R. C. Compression Paraplegia in Lymphadenoma. *Lancet* 2: 807-809, Oct. 15, 1927.
5. FORREST, D. Case of Transient Paraplegia.

in Hodgkin's Disease Lancet 2 809-810 Oct 15 1927

6 GINSBURG, S Hodgkin's Disease, with Pre dominant Localization in Nervous System, Early Diagnosis and Radiotherapy Arch Int Med 39 571-595 April 1927

7 GOLDMAN, L B Hodgkin's Disease, Analysis of 212 Cases J A M A 114 1611-1616, April 27, 1940

8 GRAY, R C, BAKER A B, COTTRELL, L, AND SKEGLAND J E Hodgkin's Disease of Central Nervous System Internat Clin 4 230-236, December 1941

9 HARE D C LEPPER, E H AND WEBER, F P Two Cases of Lymphogranulomatosis Maligna One with Involvement of Vertebral Periosteum Lancet 1 334-337 Feb 13, 1932

10 KESCHNER, M A Case of Hodgkin's Disease with Compression of the Spinal Cord, Following Trauma to the Back J Mt Sinai Hosp 5 301-310, 1938

11 LAMB, F H Lymphomatous Compression of the Spinal Cord with Case Report of Hodgkin's Type Am J Clin Path 3 155-166, March 1933

12 MEYER, O O Some Therapeutic Experiences with Hodgkin's Disease J A M A 117 595-599, Aug 23 1941

13 PAULLIN, J E Central Nervous System Manifestations of Lymphogranuloma Internat Clin 4 192-196, December 1931

14 ROSH R Vertebral Involvement in Hodgkin's Disease Report of Three Cases Radiology 26 454-458, April 1936

15 SHAPIRO P F Changes of Spinal Cord in Hodgkin's Disease Arch Neurol & Psychiat 24 509-524, September 1930

16 VIETS, H R, AND HUNTER, F T Lymphoblastomatous Involvement of the Nervous System Arch Neurol & Psychiat 29 1246-1262, June 1933

17 WEBER, F P Paraplegia and Cauda Equina Symptoms in Lymphogranulomatosis Maligna (Hodgkin's Disease) Quart J Med 17 1-5, October 1923

18 WEIL, A Spinal Cord Changes in Lymphogranulomatosis Arch Neurol & Psychiat 26 1009-1026, November 1931

19 WHEATLEY L F Lymphoblastoma with Paraplegia and Prolonged Irradiation J A M A 104 460-461, Feb 9 1935

20 WINKELMAN N W, AND MOORE M T Lymphogranulomatosis (Hodgkin's Disease) of the Nervous System Arch Neurol & Psychiat 45 304-318, February 1941

#### SUMARIO

### Compresión de la Médula Espinal Ocasionada por Enfermedad de Hodgkin Observaciones Clínicas y Tratamiento

Entre 305 casos de enfermedad de Hodgkin tratados por el Departamento de Radioterapia de los Hospitales de la Universidad de Minnesota en el período 1926-1947, en 11 había compresión de la médula espinal. En 8 de éstos se confirmó en la operación o en la autopsia la presencia de una tumefacción epidural. El síntoma inicial fué por lo general dolor de distribución radicular, con aparición subsiguiente de paresia y parálisis de los miembros e incontinencia intestinal y vesical. El examen radiológico del raquis reveló alteraciones óseas en 5 casos y la mielografía con pantopaco o lipiodol localizó la obstrucción raquídea en 3 casos.

El tratamiento consistió, en general, en

la laminectomía, ejecutada como procedimiento de urgencia cuando se observaba una compresión intraespinal aguda, seguida de la roentgenoterapia. La actual técnica roentgenológica es la siguiente: 1200 r al aire a cada uno de 3 campos (1 posterior y 2 oblicuos posteriores), 200-300 r diarios al aire por unas tres semanas, 220 kv, 60 ó 70 cm de distancia foco-piel, filtración por 1 mm Cu y 1 mm Al, c h-r, 17 mm Cu. En 6 de los 11 enfermos obtuvieron satisfactorias remisiones clínicas y neurológicas.

Opinan los AA que la roentgenoterapia intensa y temprana en la "etapa dolorosa" de la invasión raquídea, puede impedir la aparición de una paraplejía.

# Bilateral Ureterocele

## Report of a Case with Acute Right-Sided Obstruction<sup>1</sup>

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THE FOLLOWING case of bilateral ureterocele is believed to be of interest because it further confirms the very favorable—in this case dramatic—results obtained with conservative transurethral fulguration. In addition, it was possible to obtain very satisfactory roentgenograms of the anomalies by a modification of the routine method. The diagnostic and therapeutic measures were performed aboard a United States Navy Hospital Ship.

A ureterocele is a saccular dilatation of the lower end of the ureter into the bladder. It is usually considered to be the result of increased intraureteral pressure acting against a combination of two congenital anomalies: atresia or stenosis of the ureteral orifice and a deficiency of connective-tissue attachment (Waldeyer's sheath) of the ureter to the bladder.

The characteristic roentgen finding in ureterocele is a cystic ballooning or spherical dilatation of the lower end of the ureter as seen on intravenous urography or retrograde pyelography. The cystogram may show a spherical filling defect in the region of the ureteral orifice. In addition, evidence of obstructive uropathy, including dilatation of the renal pelvis and blunting and clubbing of the calices, may be noted on the affected side.

While ureteroceles are relatively frequent urological anomalies, Herman (5) states that they are bilateral in only 10 per cent of cases.

Gutierrez (4) and Thompson and Greene (7) have shown that for the ureterocele of average size transurethral fulguration through the entire thickness of its wall is a satisfactory method for enlarging the stenosed ureteral orifice. It is also the consensus of opinion that with bilateral ureteroceles only one should be treated at a time.

### CASE REPORT

An 18-year-old white seaman was admitted to the urological service of the hospital ship from an aircraft carrier on March 1, 1947, complaining of "blood in the urine" of seven days duration. He gave a history of intermittent gross hematuria accompanied by burning but no pain. The blood was described as being throughout the urinary stream. No blood clots were observed. Four days before admission the bleeding stopped spontaneously. At that time a vague suprapubic discomfort was noticed.

Nearly two years earlier the patient had an acute non-specific urethritis, which was treated successfully with sulfadiazine. For the past year he had had slight difficulty initiating the urinary stream. The family history revealed that his mother had "kidney disease" many years ago, from which she had apparently recovered uneventfully.

On admission to the hospital ship, the patient was completely asymptomatic except for slight difficulty in starting the urinary stream. The only positive finding on physical examination was a slightly boggy left lateral lobe of the prostate, indicating a low-grade chronic prostatitis. Prostatic expression showed 15 to 20 white blood cells per high power field. A three glass urine test and repeated urinalyses were negative. An intravenous urogram revealed minimal dilatation and blunting of the minor calices of the right kidney and marked dilatation of the lower third of each ureter. The ureterovesical orifices were not well shown.

Cystoscopy was performed, and large ureteroceles were observed bilaterally. Covering each ureterocele were greatly dilated vessels, diminishing to finer networks at the apices. The left ureterocele was approximately 3 cm in diameter, with a small ureteral orifice at the summit. Peristalsis was present, though poor. Following intravenous injection of indigo carmine, the dye appeared in good concentration at the stenotic orifice in eight minutes. The larger right ureterocele was about 4.5 cm in diameter. A pin point ureteral orifice was observed with difficulty on the postero-medial aspect of the protrusion. No peristalsis was observed. The indigo carmine did not appear after twenty minutes following intravenous injection. A dilute thread-like stream of dye was noted at approximately thirty minutes, however, oozing from the orifice.

The large right ureterocele remained the same size, while the left partially collapsed and distended as it emptied and refilled with urine. In the empty state the redundant walls were thrown into rugae. No other anomalies were noted within the bladder.

<sup>1</sup> Accepted for publication in September 1947.



Fig 1 Roentgenogram made in the supine position following the instillation of 22 c c of 3 per cent sodium iodide solution into the right ureteral catheter and 18 c c into the left ureteral catheter by means of a gravity technic. The catheters were then plugged and the bladder distended with 220 c c of air. Note the spherical ureteroceles filled with contrast medium standing out in contrast against the air filled bladder. The right ureteral catheter is coiled within the ureterocele. There is minimal blunting of the minor calices of the right kidney.

Cystography was performed using a standard 13.5 per cent solution of sodium iodide as the contrast medium. The films failed to reveal the ureteroceles. There were no filling defects within the bladder, and no contrast medium entered the ureters. Better results might have been obtained with a more dilute contrast medium, but it was decided to employ a double contrast study with sodium iodide in the ureteroceles and air in the bladder.

Cystoscopy was performed, and with great difficulty, due to malposition, the right ureteral orifice was dilated to permit entrance of a No. 3 catheter. The left orifice was dilated and a No. 5 catheter was inserted. Both catheters were passed to the 23 cm mark. It was later observed that the right catheter had curled unobserved within the ureterocele. Urine from the right kidney was grossly cloudy and contained many pus cells, singly and in clumps. The urine specimen from the left kidney was clear but contained from 8 to 15 white blood cells per high-power field. A 3 per cent sodium iodide solution was instilled into each catheter by gravity technic to a total of 22 c c on the right and 18 c c on the left.



Fig 2 Roentgenogram made in the right posterior oblique position after withdrawal of the catheters. The large right ureterocele is shown *en face* through the air filled bladder.

The catheters were then plugged and the urinary bladder was distended with 220 c c of air, at which time the patient complained of mild suprapubic pain. A film was taken with the catheters in place and the patient supine (Fig 1). After withdrawal of the catheters films were taken in the supine and each posterior oblique position (Figs 2 and 3). A final film was taken with the patient semi-erect.

Seven days later, dull left costovertebral angle pain developed, with shaking chills and a temperature elevation of 103 to 105° F. Sulfadiazine and penicillin therapy failed to control the infection, and the temperature rose to 106° F. The patient became mildly disoriented. An attempt to catheterize the right ureter in order to obtain drainage of the right kidney was unsuccessful.

Following preoperative preparation, the right ureteral orifice was greatly enlarged by transurethral fulguration under spinal anesthesia. Twenty-four cubic centimeters of grossly cloudy urine was withdrawn from the right kidney and the pelvis gently irrigated with acriflavine 1:8,000 dilution. In two hours the temperature had dropped four degrees. The following day it was normal.

On the 34th hospital day, ten days following the above operation, the left ureteral orifice was enlarged by transurethral fulguration, again under spinal anesthesia.



Fig 3 Roentgenogram made in the supine position after withdrawal of the catheters. The dilatation of the lower thirds of the ureters is well shown. The arrows indicate air within the bladder.



Fig 4 Bilateral retrograde pyelogram made four weeks after the second transurethral fulguration. The patient was in the supine position following removal of the catheters. Note the normal appearance of the left ureter and the minimal dilatation of the lower third of the right ureter. The right renal pelvis and calices appeared normal.

Follow-up cystoscopic examination two weeks later revealed the new ureteral orifices of such diameter that the possibility of secondary inflammatory occlusion was most unlikely. Indigo carmine injected intravenously appeared in four minutes and in excellent concentration at both ureteral orifices. Examination of urine from both kidneys showed no evidence of pyuria. Excretory urograms were not done because of the patient's sensitivity to diodrast, as evidenced by generalized urticaria following the initial intravenous study. Final retrograde pyelograms showed only minimal remaining dilatation of the lower third of the right ureter. The left ureter appeared normal (see Fig 4). A film obtained after fifteen minutes in the semi erect position revealed no dye remaining in the ureters, indicating that all obstruction had been completely removed. On May 1, 1947, the patient was discharged to full duty.

#### DISCUSSION

This patient presented one of the more serious complications of ureterocele, namely, complete obstruction and secondary pyelonephritis. He became acutely ill, and chemotherapy was of no avail. Fortunately facilities were available for prompt urological intervention. After the failure

of simple ureteral dilatation, transurethral fulguration of the ureterocele produced dramatic relief of symptoms and prevented certain irreversible renal damage.

After intravenous urography and routine cystography had failed to demonstrate the ureterocele, we were able to show them very satisfactorily by employing double contrast studies with sodium iodide injected into the ureterocele through ureteral catheters, and air in the bladder. No description of this particular method was found in standard texts of roentgen diagnosis. Although we were not aware of it at the time, the technic employed is a modification of that used by Mingazzini (9), in which a pneumocystogram is used in conjunction with excretory urography.

#### SUMMARY

A case of bilateral ureterocele with acute ureteral obstruction is presented.

Conservative transurethral fulguration of the ureteral orifices in two stages was performed, with favorable results. Films obtained by using a modification of the standard technic accurately and clearly demonstrate the condition. Impaired function of the right kidney and delayed emptying time bilaterally were reversible changes and have completely disappeared since operation.

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#### REFERENCES

1. DODSON, A. I. *Urological Surgery*. St. Louis: C. V. Mosby Co., 1944, pp. 375-377.
2. EISENDRATH, D. N., AND ROLNICK, H. C. *Urology*. Philadelphia: J. B. Lippincott Co., 1943, pp. 548-551.
3. GOLDEN, R. (Ed.). *Diagnostic Roentgenology*. New York: Thomas Nelson & Sons, 1941, Vol. II, pp. 643, 712.
4. GUTIERREZ, R. *Modern Surgical Treatment of Ureterocele*. *Surg., Gynec. & Obst.* 68: 611-630, 1939.
5. HERMAN, L. *Practice of Urology*. Philadelphia: W. B. Saunders Co., 1938, pp. 344-347.
6. SHANKS, S. C., KERLEY, P., AND TWINING, E. W. *A Textbook of X-Ray Diagnosis by British Authors*. London: H. K. Lewis & Co., 1938, Vol. 1, p. 559.
7. THOMPSON, G. J., AND GREENE, L. F. *Ureterocele: A Clinical Study and a Report of 37 Cases*. *Proc. Staff Meet. Mayo Clin.* 17: 133-136, March 4, 1942.
8. WESSON, M. B., AND RUGGLES, H. E. *Urological Roentgenology*. Philadelphia: Lea & Febiger, 1936, pp. 78-79.
9. MINGAZZINI, E. *Ztschr. f. Urol. Chir.* 41: 163, 1936. Quoted by Eisendrath and Rolnick (2).

#### SUMARIO

#### Ureterocele Bilateral. Comunicación de un Caso con Obstrucción Aguda del Lado Derecho

Preséntase un caso de ureterocele bilateral con obstrucción ureteral aguda en un joven de 18 años. El estado fué revelado exacta y claramente con una modificación de la técnica roentgenológica corriente, o sea, dobles estudios de contraste con yoduro de sodio inyectado en los ureteroceles con sondas ureterales y aire en

la vejiga. La fulguración transuretral conservadora de los orificios ureterales fué ejecutada en dos tiempos, con resultado favorable. La disfunción del riñón derecho y el retardo bilateral del tiempo de vaciamiento resultaron ser alteraciones reversibles, que desaparecieron completamente después de la intervención.



# Beam Localization and Depth Dose Determination<sup>1</sup>

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THE RANGE OF THE lethal tumor dose for various malignant neoplasms has been roughly defined, and the practice of delivering this dose within an optimum period of time has also become established. This is evident in the radiation treatment of epidermoid carcinoma of the skin, larynx, and cervix, so that one might assume that similar results should be possible with

age, moreover, the choice of fields in cross-firing must be such as to give the greatest economy of tumor dose in proportion to the skin dose (1, 2). The tumor dose through each port should be as nearly uniform as possible, so as to obtain homogeneous irradiation of each tumor segment and the tumor bed.

Air dose and skin dose become increas-

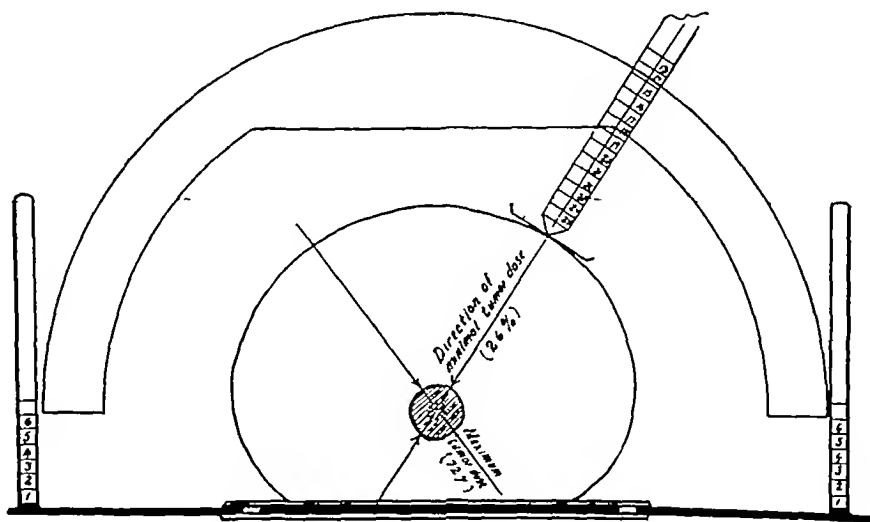


Fig 1 Illustrating bladder, rectal or spinal tumor treated through four ports with the depth dose from the near port 72 per cent and from the far port 26 per cent. Under such conditions the volume dose is large and the treatment is inefficient.

epidermoid carcinomas of the esophagus and lung. Heavier filtration, increase in the focal skin distance, and higher kilovoltage have made possible a greater depth dose, but radiation sickness from too large a volume dose and local skin reaction have proved to be limiting factors in the delivery of the required amount within the optimum period of time. Volume dose depends chiefly on the field area, treatment site, thickness of the tissue traversed by the radiant energy, and homogeneity of dos-

ingly less important as one increases the number of ports and the quality of radiation. In treatment of deep-seated lesions it becomes imperative to think in terms of tumor dose if one is to avoid over-irradiation of a thin patient or under-irradiation of a stout one. The practice of cross-firing through four large ports to skin tolerance is inefficient, especially if the size, site, and depth of the tumor are not precisely known. A bladder tumor may be 6 cm from the ventral surface and 15 cm from the dorsal

<sup>1</sup> Developed in the Radiation Therapy Department, Bellevue Hospital, New York, N. Y. Ira I. Kaplan, Director. Paper read by title at the Thirty-third Annual Meeting of the Radiological Society of North America, Boston, Mass., Nov. 30-Dec. 5, 1947.



Fig 2 Method of calculating distance from dorsum to center of esophageal lesion (see text)

surface, whereas with a rectal or a cervical tumor this situation may be reversed.

The percentage depth dose to a tumor 15 cm below the skin is small, being 24 per cent of the air dose at 200 kv p with 0.5 mm Cu plus 1 mm Al, 10 × 10 cm port, and 50 cm focal skin distance. Since this results in a poor yield of tumor dose even when skin tolerance is approached (480 r for 2,000 r in air and 2,720 r on the skin), we avoid such distant ports whenever possible. At 6 cm, the depth dose is 72 per cent of the air dose. If isodose curves be made of a tumor treated through four ports

6 and 15 cm from the tumor, and with the above factors, it will be seen that there is a great difference between the value of the tumor dose from the beam through the distant port and that from the beam through the near port. The ratio of the minimum tumor dose to the difference between the maximum and minimum is known as the "economy quotient" and is an indication of therapeutic efficiency (1, 2). When the difference between the maximum and minimum tumor dose is small, homogeneous irradiation occurs and the volume dose is also small (Fig 1).

If the number of ports be made great enough and the size of each port held to the smallest possible area, irradiation of a tumor is accomplished with the least skin reaction and least volume dose. One should be reluctant to irradiate a tumor-bearing volume through a large port at the expense of back-scatter from normal tissue. Moreover, the variation in the intensity within the field of irradiation may be as great as 20 per cent at the periphery of a  $15 \times 15$  cm port (6). The therapist works with such a complex set of variables and unknowns that every effort at achieving precision and scientific rigor should be made. Empirical cross-firing at a tumor whose site and volume are only dimly estimated may result in unnecessary irradiation of a large volume of normal tissue without delivery of an adequate or homogeneous tumor dose. The net result will be a patient with a smoldering neoplasm and a blistered skin.

Since the areas of the ports and their locations are the most significant factors in volume dose, with kilovoltage, filtration, and focal skin distance of less importance, the reason for the choice of proper ports to give approximately equal depth dose and total tumor dose from each is clearly evident. Thus, when 14 ports are available, with the depth of the tumor ranging from 8 to 15 cm, usually 8 to 10 ports will be found to fall within the range of 8 to 13 cm, those above 14 cm are usually discarded and the air dose is altered so that the final tumor dose through each port is about the same.

During World War I, a protractor device was employed for localization of foreign bodies (3), and in 1939 Dobbie (4) described a similar instrument for the localization of a therapy beam whereby the central ray to any port could be determined and the depth of the lesion from the skin at any point on the body surface could be measured. A further modification of the protractor method is presented, permitting a more generalized application to deep-seated lesions.

With the aid of dorso-ventral and lateral roentgenograms the location of the center

of the tumor is plotted in relation to the skin surfaces. Lesions in hollow viscera, as the pharynx, larynx, esophagus, stomach, and gallbladder, may be visualized following ingestion of a contrast medium, lesions in the kidneys, bladder, uterus, cervix, rectum, and colon after injection of a medium, lesions in solid structures by soft-tissue radiography or by insertion of an inert gold radon seed into the estimated center of the lesion. Where laminagraphy is available, this offers the simplest and most precise means of obtaining all the data needed. Endoscopy and physical examination provide additional information.

For example, in preparing for therapy a patient with carcinoma of the esophagus, roentgenograms are made in the dorso-ventral and lateral positions during ingestion of barium. Thin strips of lead markers are secured to the skin with adhesive at the approximate level of the tumor. The lateral and dorso-ventral diameters between the markers are measured with calipers at the time the films are made. The same diameters are measured on the dry film, together with the distance from the tumor center to the dorsal skin surface on the lateral view. Since the caliper measurement, the dorso-ventral diameter on the film, and the distance of the center of the tumor from the dorsal skin surface are known, the true distance from the skin to the tumor can be calculated by ratio and proportion. The linear extent of the lesion and its relation to the ventral body surface are found by the same method. Focal skin distance and every other optical factor in projection are ignored. For instance, if the distance from the center of the lesion to the dorsal skin surface as measured on the film is 12.3 cm, and the total film diameter is 23.5 cm, the caliper measurement on the patient at the same level is found to be 19 cm. The true distance corrected for magnification and distortion is calculated as follows:

$$19 \div 23.5 \times 12.3 = 10.0 \text{ cm}$$

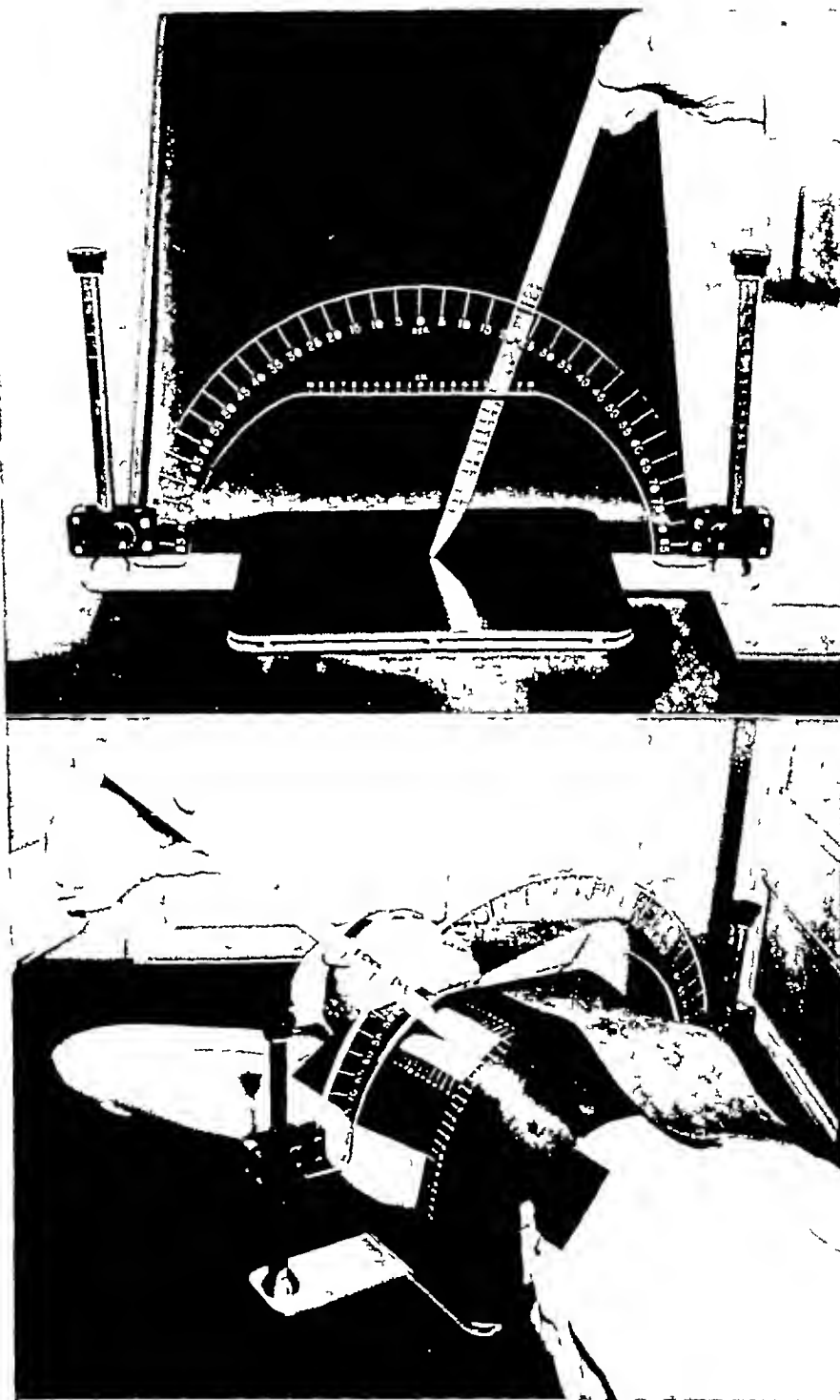
which is the true distance from center to dorsal skin surface (Fig. 2)



Fig 3 Method of calculating distance to center of esophageal tumor from a fixed anatomical landmark, as the sternal notch (see text)

The center of the lesion must also be localized with respect to a fixed anatomical landmark on the body surface, such as the sternal notch (Fig 3). Its position in relation to the mid-line, whether on or off center, is next determined. Having thus localized the center in relation to three axes and calculated that the respective distances are 10.0 cm from the dorsal skin surface, 10.0 cm below the sternal notch, and nearly on the mid-line, and having observed that the lesion is 13 cm in length on the film (we routinely extend the field of irradiation 3 cm beyond the upper and lower limits as shown on the film), we inscribe a master port on the ventral surface of the patient's body. The center of this port lies directly over the center of the tumor. As many ports as are feasible are inscribed around the body surface, leaving at least 1 cm space between the ports.

With these data, we are ready to use the protractor for determination of the angle which the central ray must make to the center of each port and of the skin-tumor distance for each port. The protractor (Fig 4) consists of a slotted base open at the sides so that a sliding metal sheet can be moved freely in two planes with respect to a patient lying on the base (transversely and either cephalad or caudad). Vertical posts graduated in centimeters from 0 to 20 are fixed at the ends of the metal sheet. The protractor is made of clear plastic material shaped into a semicircle of 26 cm radius to the outer circumference, and graduated in units of 5 degrees from 0 mid-point to 90 at the ends. A linear scale from 0 to 10 cm in either direction is marked off near the lower circumference. Sleeves are fixed to the ends of the protractor so that it may be moved up and down on



Figs 4 and 5 The protractor and applicator rod are shown in Fig 4 (above) Fig 5 (below) shows the method of obtaining the angle of the central ray through the center of a port to center of tumor and distance to tumor from skin The angle is  $46^{\circ}$  and the distance is 14.5 cm

the vertical posts and held at any desired level by fixation screws

The patient is placed on the base with the lesion approximately in the center, and the protractor is fitted on the vertical posts. From the data previously obtained, we know that the esophagus lies 10.0 cm from the dorsal skin surface. The protractor is therefore elevated that distance above the base, bringing the ends of the semicircular plastic arc on a level with the lesion. The entire protractor is then adjusted until the zero degree radius is directly over the mid-

of a rod marked off in centimeters from 26 at the bottom to 0 toward the top. This applicator rod is placed against the plastic arc with the point at the center of the port and the edge lined up with the degree parallel to it on the arc. The point at which the outer circumference cuts the linear scale on the rod gives the skin-tumor distance. (The tumor is at the center of the plastic arc whose radius is 26 cm. The distance from the skin to the circumference can be measured, hence the difference between that value and 26 cm is

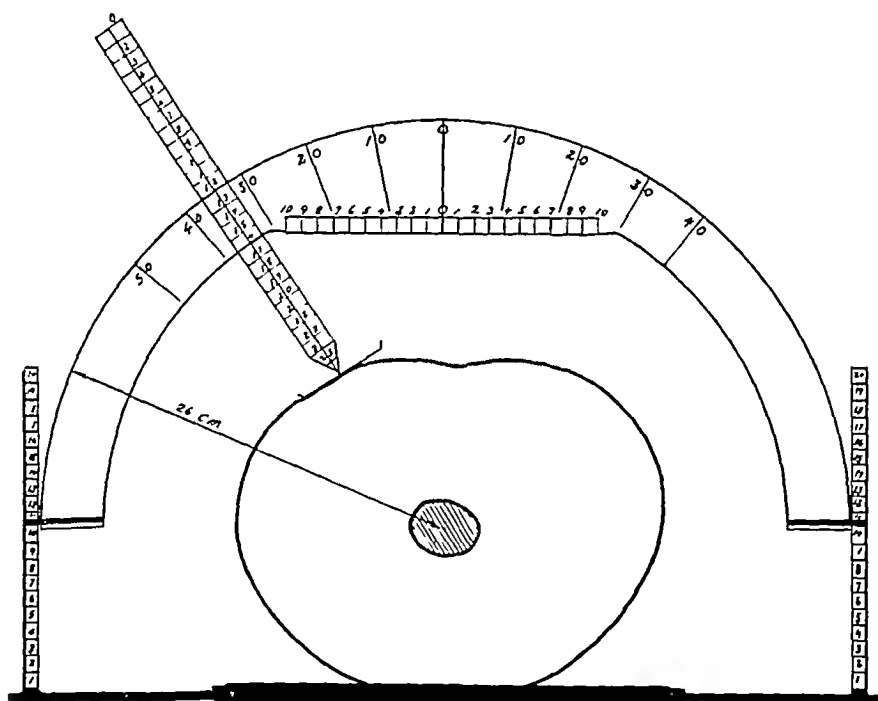


Fig 6 Cross section of mid-line tumor with diagram of protractor to illustrate principle in obtaining angle of central ray and distance to tumor

line and the transverse position of the arc lies over a point 10.0 cm below the sternal notch. The center of the lesion has now become the center of a 26 cm semicircle, which is the outer circumference of the protractor. Thus, every point on this circumference is exactly 26 cm from the center of the lesion and all radii intersect at that center.

The midpoint of each  $6 \times 15$  cm port (in this case) is the focus of the central ray, and the angle made is determined by means

the tumor depth. The scale on the applicator rod is 26 cm in length. When the rod is aligned to a port at the proper angle, it measures the skin-circumference distance and leaves a remainder which is the tumor depth. (See Figs 5 and 6 for graphic examples and analysis.) When all possible anterior ports have been calculated, the patient is turned into the prone position and the protractor is elevated a height equal to the distance from the center of the master port on the ventral skin surface to

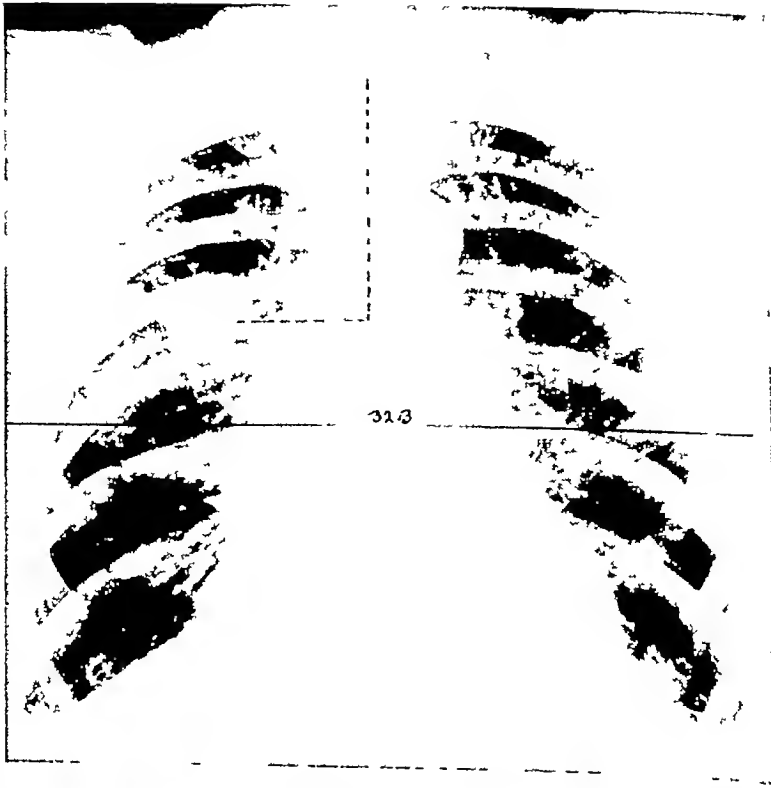


Fig 7 Method of calculating distance of off-center lesion from mid-line and sternal notch

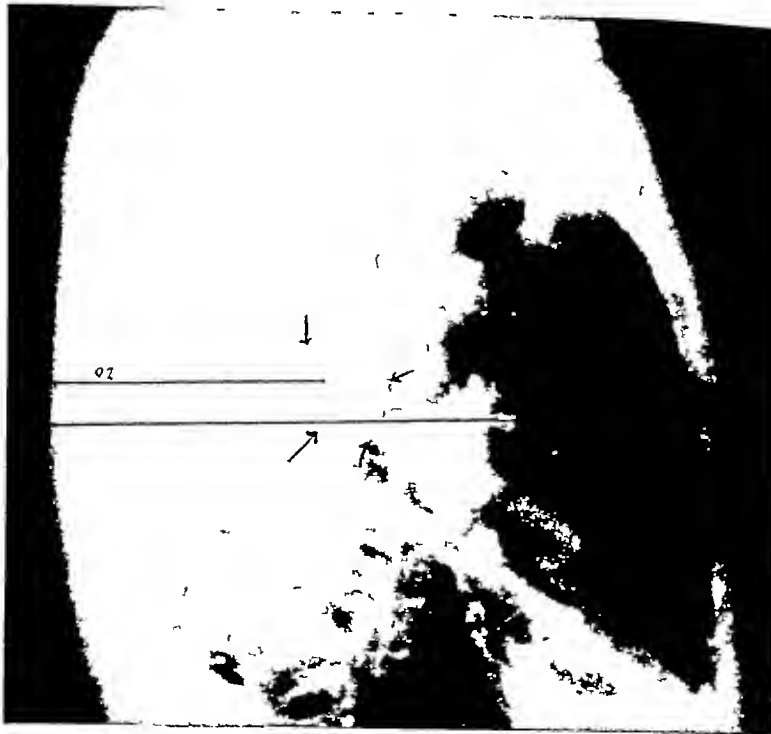


Fig 8 Method of calculating distance from dorsum to tumor

the center of the tumor (Care must be taken that the chest wall is in contact with the baseboard or, if a hiatus exists, that adjustment is made to compensate) The posterior ports are then calculated as described for the anterior

When the lesion is off-center, for example 5 cm from the mid-line, as in lung, kidney, brain, etc., the protractor is moved transversely across the patient until the 5 cm point on the linear scale is directly over the mid-line of the body. The zero point is

especially in off-center lesions. The contours of the body are such that the cone will not be closely applied to the entire port area in every instance (except where the unit is without cones but has instead lead diaphragms that may be adjusted for any size port and any rectangular shape), often a hiatus of 1 to 3 cm may be present at the far edge, thus increasing focal skin distance. This may be ignored, or the error of 4 to 12 per cent may be compensated for by supplementary treatment

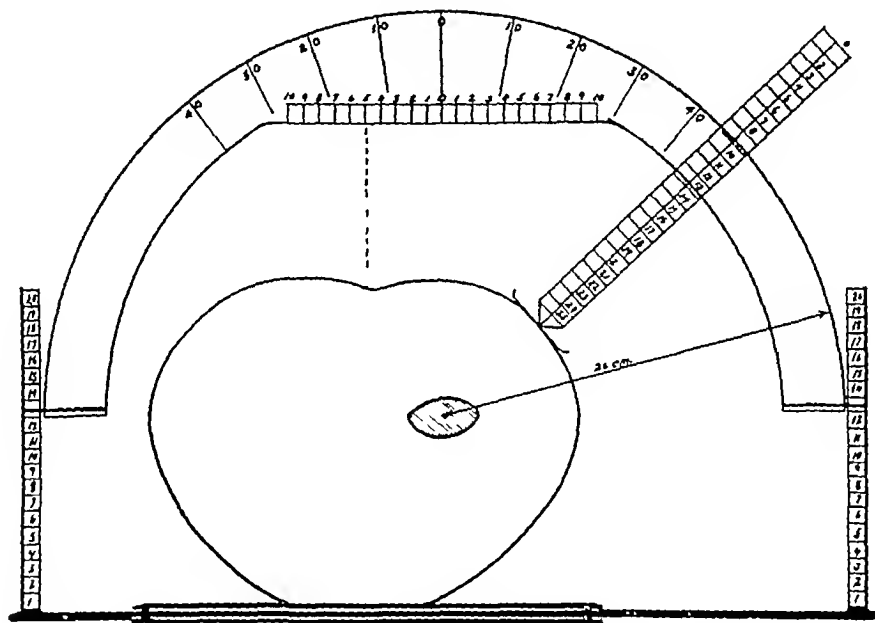


Fig 9 Cross section of off center tumor with diagram of protractor to illustrate principle of obtaining angle of central ray and distance to tumor

now over the center of the tumor and once again all radii of the 26 cm semicircle converge upon it. The same steps for calculation as outlined for the esophagus may then be followed (Figs 7, 8, and 9)

Since very few therapy units are equipped with an angle scale to reproduce exactly the angle desired, the patient may be left on the base and the protractor shifted up or down the long axis of the body so that the therapy cone can be sighted along the degree marker on the plastic arc (Fig 10)

Not every port available will be economical, since the tumor depth may be too great to yield a significant tumor dose,

amounting to the required number of roentgens. An integrating ionization chamber on the skin at the portal center creates a nearly ideal way in which to calculate the skin dose and hence the depth dose. In extreme cases, the cone may be removed and the distance reduced by 1 to 2 cm. In any event, the portal is screened off with heavy lead rubber.

The efficacy of the method depends on the patience, ingenuity, and precision with which the radiologist plans the treatment. The accuracy of the protractor in directing the central ray through the center of the tumor can be checked by roentgeno-

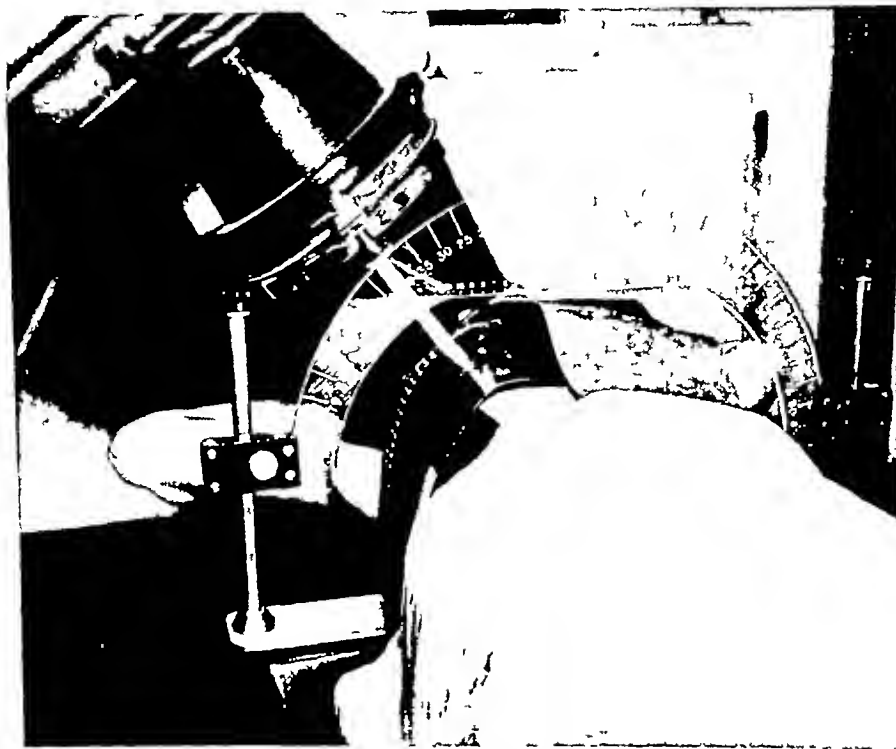


Fig 10 Showing protractor moved caudad and central ray of cone lined up with required angle on protractor in event the therapy unit is not equipped with an angle scale

grams made with the therapy unit while the patient is in actual treatment position (Figs 11 and 12)

In practice, it has been found that disagreement frequently occurs when two unpractised persons attempt to measure the angle to the same port. For example, one may calculate the central ray to be 40 degrees, whereas another may state it to be 44 or 36 degrees. With a little practice, the correct angle can readily be determined within one or two degrees. The physical apparatus can be standardized precisely, but the therapist and the patient constitute two variables that may result in an indeterminate product. To meet any criticism of possible error or laxity in technique, the accuracy of the method has been checked by geometrical analysis, and it has been found that an error of plus or minus 5 degrees throws the beam off center at a depth of 10 cm by only 8 mm (5). With this method, even so small a skin port as  $6 \times 12$  cm will always encompass a tumor whose dimensions are no greater, since at a

10 cm depth the beam will diverge to  $7.2 \times 14.4$  cm. Such will not be the case where the tube head is angulated by guess in conventional cross-fire irradiation, inasmuch as a deviation of 5 degrees from the true angle will throw the beam completely beyond the limits of the tumor, even though its location is accurately known (Fig 12). It is a significant fact that heretofore so few manufacturers have had scales on their equipment to measure the angle of the central ray. Reproduction and control of conditions from day to day as treatment continues are not readily possible by empirical means.

With 8 to 12 ports, homogeneous saturation of the tumor area is possible, whereas skin reaction rarely amounts to more than a first-degree erythema, and no portion of the tumor bed will be over- or under-irradiated. The treatment is planned to deliver a tumor dose of 200 to 300 r daily through two ports over twenty to thirty treatment days. These two daily ports are oppositely placed, and a tumor dose of 100 to

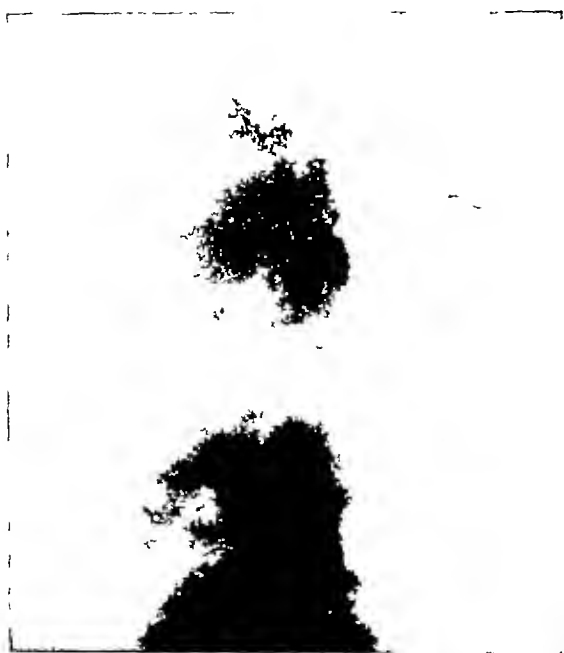


Fig 11 Roentgenogram made of lung tumor (Figs 7 and 8) with therapy machine during actual treatment conditions to check on accuracy of aiming. Note tumor in exact center of field.



Fig 12 Roentgenogram of esophageal tumor (Figs 2 and 3) with therapy machine to check on accuracy of angulation. Note barium in esophagus at upper half of film and course through center of field.

150 r is given through each. The rationale for this is based on the fact that with a large dose through one port, the skin dose is high and tissue recovery within the tumor is

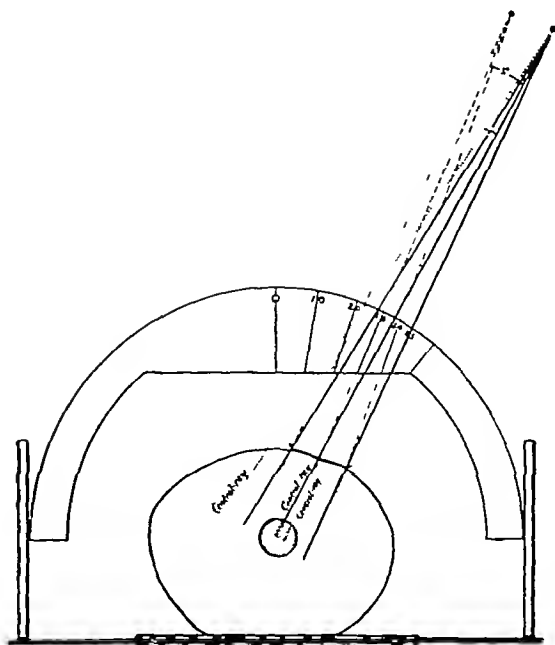


Fig 13 Solid projection lines show proper treatment conditions with central ray at  $30^\circ$  and tumor between margins of field. Broken lines show error of  $5^\circ$  made at the protractor, the central ray passes through  $25^\circ$  but is off center at the tumor by only 8 mm and the tumor is still within the limits of the field. Dotted line shows central ray passing completely beyond the tumor when an error of  $5^\circ$  is made at the target. This occurs commonly when empirical sighting is made at a tumor whose size and location are not precisely known.

also high during the interval between treatments to the same area, whereas with two opposite ports, the skin dose is small, and tissue recovery within the tumor will also be small. On the following day two portals are chosen at points removed from the first two, so that so-called "hot-spots" at the intersecting points of the adjacent beams below the skin are not produced. The portal areas vary between 70 and 100 cm<sup>2</sup>, occasionally they may be smaller, therefore, the back-scatter factor is small and  $D_0$  must be large. With 250 kilovolts, Thoræus filter and 50 cm focal skin distance,  $D_n$  varies from about 20 to 50 per cent as the depth varies from 14 to 7 cm.  $D$  at each port varies from 900 to 400, since the object is to give a uniform tumor dose rather than a uniform air dose. The latter has no particular merit except ease in planning the treatment, in keeping records, and initial calibration.

## SUMMARY AND CONCLUSION

The tendency to think in terms of lethal tumor dose and volume dose, and the trend toward multiple ports, higher filtration, and increase in focal skin distance and kilovoltage, have made accurate localization of a lesion requiring roentgen therapy imperative

Various methods of localizing the tumor with respect to landmarks on the body surface have been mentioned. A protractor, based on the British method, is used, and the manner of determining the tumor depth and angle of the central ray to any port with this protractor is described.

Multiple small treatment ports are used, and are so chosen as to produce nearly homogeneous irradiation and a small volume dose.

Treatment is planned so as to deliver 100 to 150 r daily to the tumor through each of two oppositely placed small ports, for a total amount of 5,000 to 6,000 r over a

period of twenty to thirty treatment days.

The accuracy of the method has been checked practically and mathematically, and the attempt has been made to eliminate failures due to lack of control and precision. Within the limitations of our present knowledge, we deliver a lethal tumor dose with a minimum of skin damage and radiation sickness.

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## REFERENCES

- 1 UNGAR, E. M. Simplified Method of Studying Volume Dose Distribution. *Brit J Radiol* 16: 274-278, September 1943.
- 2 ELLIS, F. Total Energy-Absorption in Radiotherapy. *Brit Med Bull* 4: 36-43, 1946.
- 3 BOURKE, V. V. A Method for the Localization of Foreign Bodies and a New Instrument to Carry Out This Method. *Radiology* 40: 56-61, January 1943.
- 4 DOBBIE, J. L. Beam Direction in X-Ray Therapy. *Brit J Radiol* 12: 121-128, February 1939.
- 5 ELLIS, F., ET AL. Beam Direction in Radiotherapy. Symposium. *Brit J Radiol* 16: 31-43, February 1943.
- 6 THAYSEN, V. E. Intensity Variations in Field of Irradiation. *Acta radiol* 26: 353-360, 1945. *Abst in Year Book of Radiology* 1946: p. 323.

## SUMARIO

## Localización del Haz y Determinación de la Dosis Profunda

La tendencia a pensar en términos de dosis tumor letal y dosis en volumen y la propensión hacia varias puertas, mayor filtración y aumento de la distancia focopiel y del kilovoltaje imponen la localización exacta de toda lesión que exige roentgenoterapia.

Se han mencionado varias técnicas para localizar el tumor en relación con ciertos puntos de referencia en la superficie del cuerpo. Descríbese la manera de determinar la profundidad del tumor y el ángulo del haz central en relación con cualquier puerta, usando para ello un protractor basado en la técnica inglesa.

Para tratamiento úsanse varias puer-

tecillas, escogidas de modo que produzcan irradiación casi homogénea y dosis de poco volumen. El tratamiento tiene por plan entregar diariamente al tumor 100 a 150 r a través de dos puertecillas opuestas, hasta alcanzar un total de 5,000 a 6,000 r durante un periodo de 20 a 30 días de tratamiento.

La exactitud del método ha sido comprobada práctica y matemáticamente, tratando de eliminar los fracasos debidos a falta de comprobación o precisión. Dentro de las limitaciones impuestas por nuestros conocimientos actuales, se entrega así una dosis tumor letal con un mínimo de lesión cutánea y de enfermedad de radiación.

# Contribution to the Radiology and Pathology of Transmissible Avian Osteopetrosis—Lymphomatosis<sup>1</sup>

J B THIERSCH, M.D.\*

THE AVIAN LEUKOSIS complex includes bony lesions called tentatively osteopetrosis gallinarum (Jungherr and Landauer, 1938), Paget's disease or osteitis deformans (Venkataraman, 1936), diffuse osteo-periostitis (Pugh, 1927), osteodystrophia fibrosa cystica (Ghos, 1934), hypertrophic osteitis (Bull and Auger, 1924, Brochet, 1935), thick leg disease, marble bone, akropachia ossea (Reinhardt, 1930)

Coles and Bronkhorst (1946), investigating the familial incidence of spontaneous osteopetrosis in fowls, claim a seasonal character of the disease and state that families stigmatized with the bony lesions never provide birds worthy of inclusion in a high-class breeding pen

From the variety of names it is evident that a variety of bony lesions has been seen by different authors. It is the object of

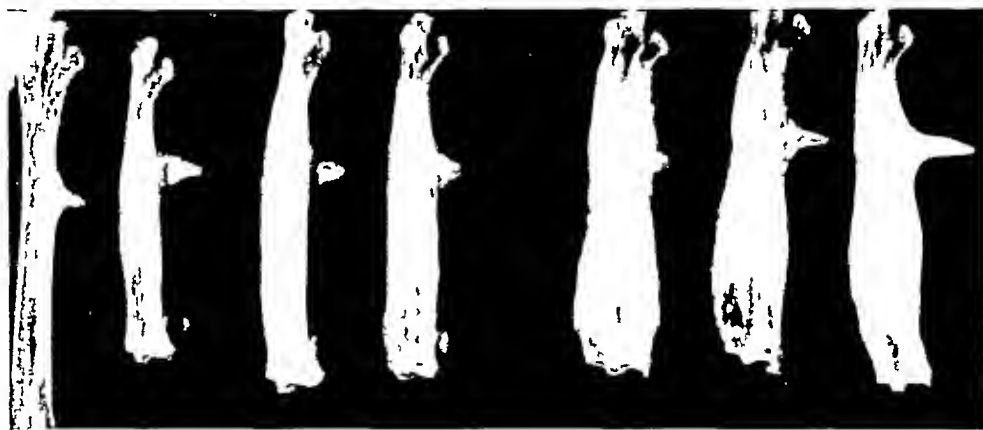


Fig 1 Roentgenograms of metatarsi of osteopetrotic birds, normal bone on left

Spontaneous cases have been reported by numerous observers (Bieley, 1943, Carpentier, 1931, and others), Eidecken (1940) furnished x-ray pictures of birds showing osteopetrotic lesions from the Vineland Poultry Laboratory, Vineland, N J, for Jungherr's article on osteopetrotic lymphomatosis in the Textbook of Diseases of Poultry (Iowa State College Press, 1944). Jungherr and Landauer (1938) found the bony lesions to be transmissible and inseparable from fowl lymphomatosis. Brandly, Nelson, and Cottral (1942) suggested etiological differences between the bony and leukemic lesions

this paper to demonstrate that this multiplicity of bony lesions belong to one and the same disease

## METHODS

Skeletal lesions were obtained weeks and months after chick embryos were injected intravenously with human myeloid leukemic material (Thiersch, 1944, 1947). Later, lesions were obtained after the injection of the one-day-old chick with human leukemic material. The disease was easily transmitted with whole blood of the adult fowl to the day-old chick. The period of development of

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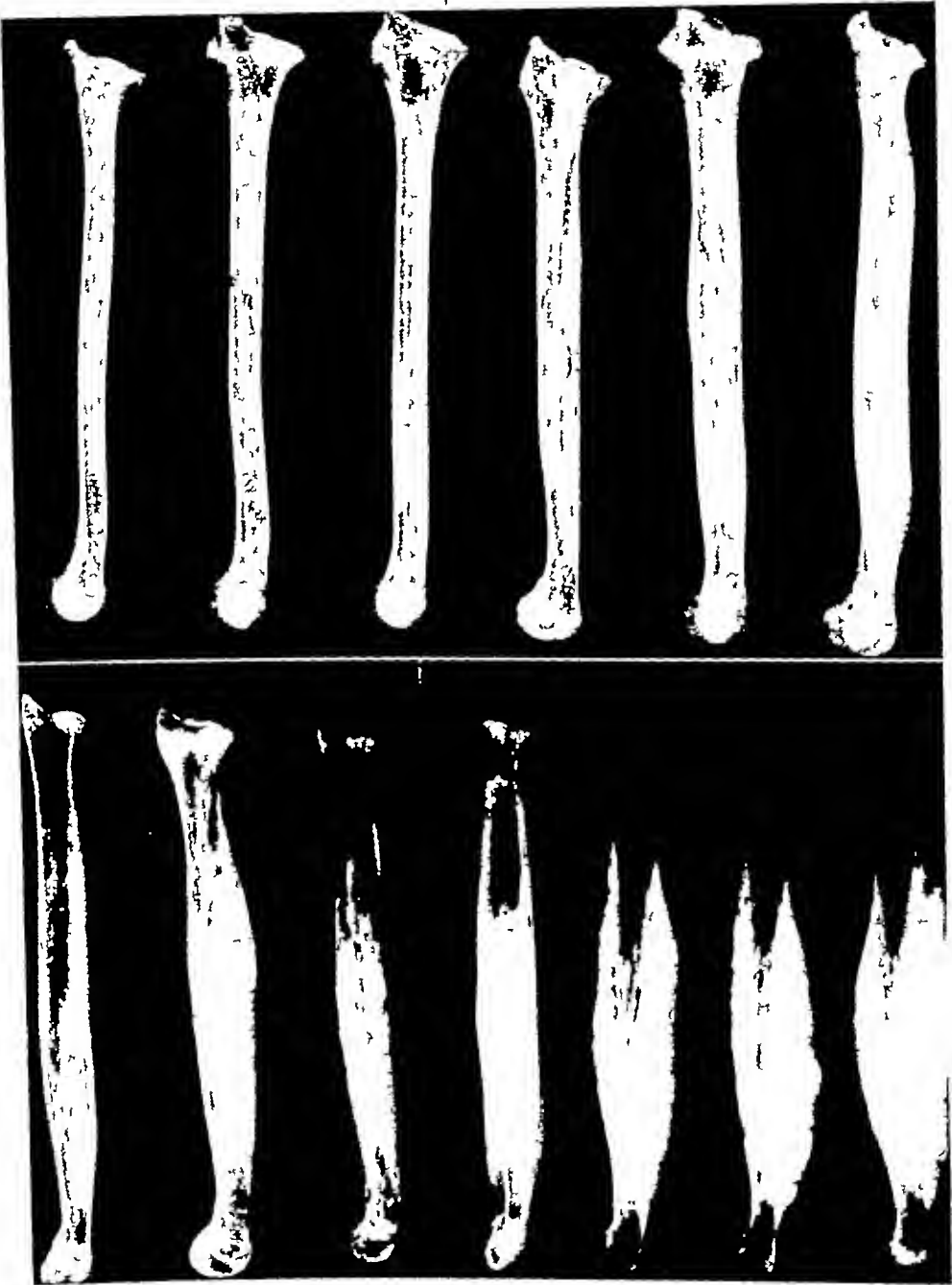


Fig 2 Roentgenograms of tibiae of osteopetrotic birds in different stages of the disease The tibia at the extreme upper left is almost normal

bony lesions shortened from six or eight months to as many weeks in subsequent passages. A great variation in time in the development of bony lesions was observed, phases of rapid bone formation alternated with resting periods. The stock used was

a first-rate white leghorn breeding strain which in the last eight years had not shown spontaneous cases of "osteopetrosis" and which, according to Coles and Bronkhurst (1946), should be free from the recessive hereditary factor

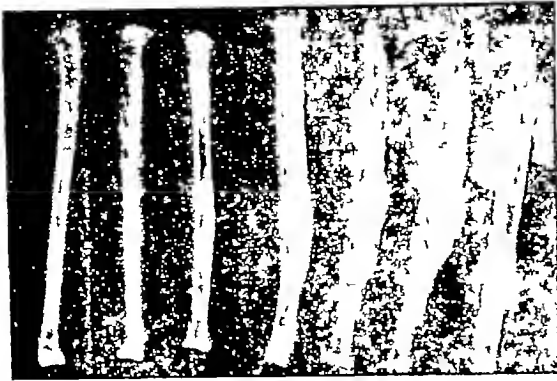


Fig 3 Roentgenograms of radii of osteopetrotic birds, normal bone on left



Fig 4 Roentgenograms of coracoides with scapulae of osteopetrotic birds

The birds were kept in batches after the inoculations, separated in cages with approximately 25 birds each. They were given a high egg-producing diet and kept under constant observation by a poultry expert. X-ray examinations were made at regular intervals, the affected birds being marked and re-examined for progress. Series of films were thus obtained showing the advance of the bony lesions. Some of the fowls were killed in the early stages and others after some months of illness, others were watched for eighteen months. At autopsy blood was collected for alkaline phosphatase estimation, sections were taken of the internal organs and bones for microscopy and fixed in 10 per cent formalin, blood and bone marrow smears were made, and the skeleton was preserved. The parathyroid glands were found to be normal in all cases.

LEUKEMIC LESIONS

Leukemic infiltrations of internal organs were not seen in the experimental birds until the third transmission, when typical lymphomatosis occurred.

PHOSPHATASE

Acid and alkaline phosphatase were estimated by the King and Armstrong method. Normal birds gave an average of 2.5 units of acid and 25 units of alkaline phosphatase. The range of alkaline phosphatase was between 20 and 30 units, of acid phosphatase between 1.7 and 3.4

TABLE I PHOSPHATASE (IN KING ARMSTRONG UNITS) IN OSTEOPETROTIC BIRDS

No	Age	Lesion	Alkaline Phosphatase	Acid Phosphatase
1	9 months	Active	105 units	
2	9 months	Active	135 units	
3	9 months	Active	140 units	
11	10 months	Active	135 units	
33	18 months	Resting	28 units	1.7 units
50	9 months	Active	103 units	2.0 units
50	10 months (repeated)	Active	102 units	1.7 units
52	10 months	Active	71 units	3.5 units
55	9 months	Resting	35 units	1.5 units
59	10 months	Active	107 units	3.9 units
79	9 months	Active	76 units	2.9 units
79	18 months (repeated)	Resting	26 units	1.1 units
100	18 months	Resting	20 units	1.3 units
Normal (80 birds)	6-18 months		25 units (average)	2.5 units (average)

King-Armstrong units. Eleven birds with osteopetrosis had a range of 1.5 to 3.9 units of acid phosphatase with a normal average of 2.5 units. The alkaline phosphatase of 11 birds with osteopetrosis varied greatly. In the active stages of the disease, values

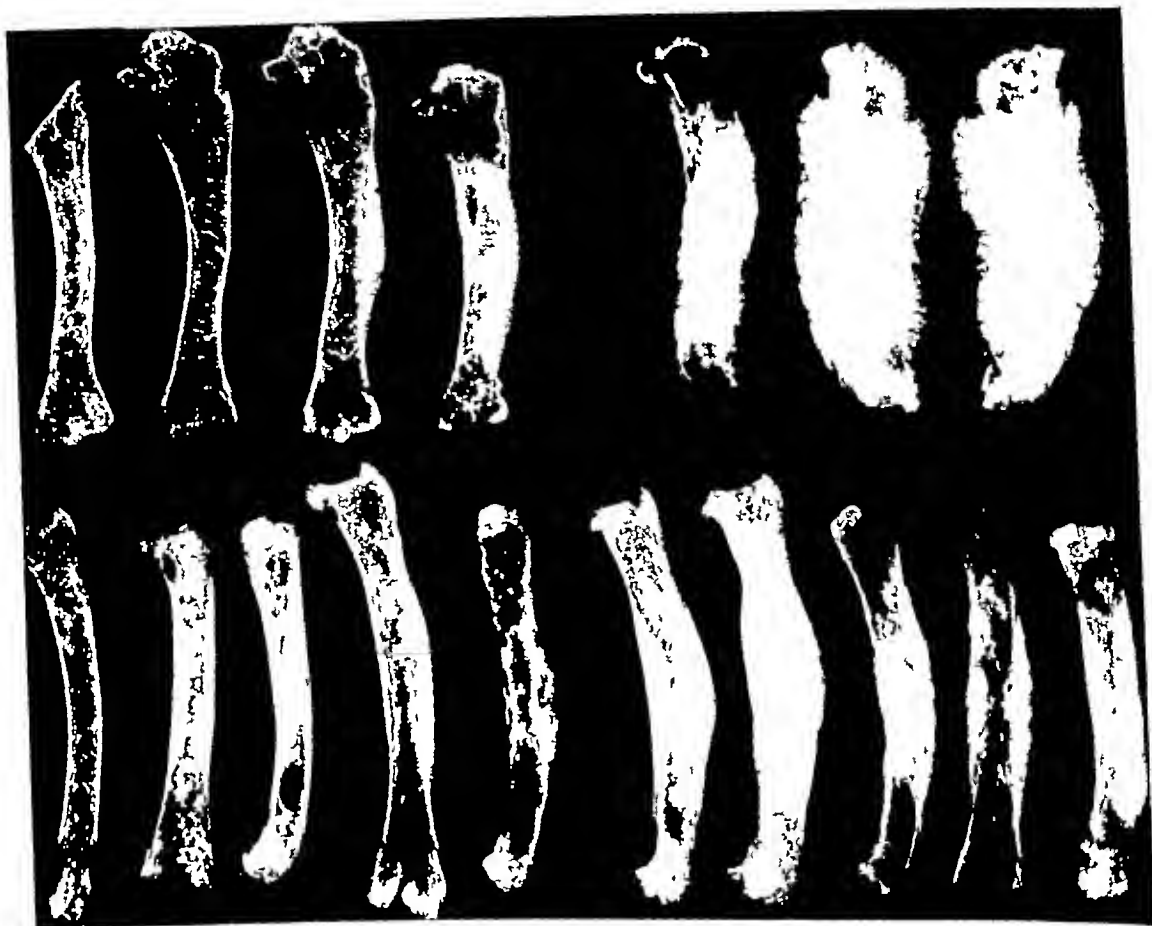


Fig 5 Roentgenograms of humeri (above) and femora (below) of osteopetrotic birds, normal bones on left.

above 100 units were obtained. After the lesions were fully developed and apparently arrested, variations of 35 to 70 units were found with normal values in a few instances (see Table I).

#### CALCIUM

The calcium content of osteopetrotic birds was found to be normal. The average serum calcium in affected birds and controls was 9.5 mg per cent.

#### ROENTGENOGRAPHIC STUDIES

The bony lesions were always bilateral. They were almost entirely confined to the diaphysis, leaving the epiphysis and the cartilaginous ends unchanged. In most birds only the tubular bones were involved, but in a few very advanced cases the flat bones, including the head and vertebrae

and the breast bones were also affected. The digits were never involved. In a number of cases the lesions appeared in the femur, tibia, or tarsus before the upper extremities were involved.

In describing the development of the lesions from the initial toward the final stages, it must be stressed that the bony changes may become arrested at any stage. Thus a great variety of lesions were obtained, explaining the descriptions by previous investigators. In some cases progress continued after some months of arrest, as indicated by x-ray films and estimations of alkaline phosphatase of the blood. In other cases rapid progress was made toward the final grotesque stages. In order to demonstrate the course of the disease, bones of birds at different stages have been collected, photographed, and x-rayed.

These pictures show the full range of bony lesions as seen in the transmission experiments. From these bones it was evident that the early stages may be very misleading, showing only widening of the shaft with osteopetrosis or endosteal thickening

process, a fact which should never be forgotten

*Endosteal Lesions* As a first sign of bone involvement, an increased trabecular marking appeared near the diaphysis, gradually extending into the metaphysis, leaving



Fig 6 Roentgenograms of sterna of osteopetrotic birds, normal bone in left upper corner

with narrowing of the central cavity. Later, ridges occurred on the periosteum, giving a coarser outline or roughness of the surface of the bones. Later still, gross abnormalities developed. In the following paragraphs the endosteal and periosteal lesions are described separately, though in reality they are manifestations of the same

eventually a fine trabecular network spanning the shaft from side to side. A few scattered patches of bone then developed in this network, producing the appearance of small irregular spots on x-ray examination. Later, a definite thickening of the cortical bone was noted, leading to an often irregular outline of the inner surface. This en-

dosteal growth of cortical bone may progress, with centripetal extension of the bone into the marrow cavity

Microscopically the lesions described by Jungherr and Landauer were found. They consisted of degeneration of old trabecular

*The Marrow Cavity* The marrow cavity shows microscopically more bony trabeculae than normal. In the later stages, the cavity was narrowed down by endosteal bone proliferation, often leaving only a small central canal. Prior to this, numer-

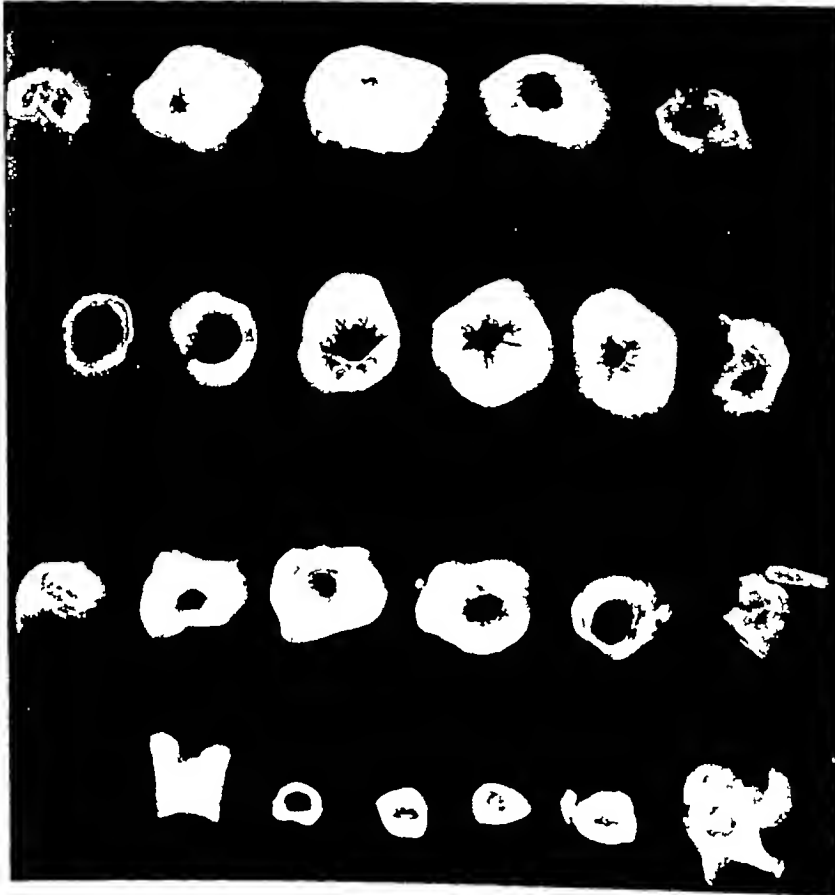


Fig 7 Roentgenograms of cross sections of a normal (bottom) and three osteopetrotic tibiae.

bone with development of vascular fibrous bony tissue. This bony tissue replaced the original bone, forming new lamellar bone with mosaic structure and irregular calcification. Often a jumble of degeneration, new fibrous bony tissues, and hypercalcified areas were found in the same section of an affected bone. Calcifications were noted as late developments after a large fine spongy bone was formed, consisting primarily of lamellar bone with a fibrous marrow.

ous subdivisions of the marrow cavity occurred, which disappeared with progressing bone proliferation and petrosis. Necrosis was also seen, due to interference with the blood supply; these areas showed later calcification and only gradual transformation into bone. If the marrow cavity showed multiple subdivision, a cystic appearance was noted on x-ray examination. In some cases the endosteal petrosis was the final stage, with only a moderate thickening of the shaft; in other cases the central cavity



Fig 8 Roentgenograms of cross sections of normal (below) and osteopetrotic humerus

was not considerably involved by comparison with normal bones. In these instances the bones consisted of lamellar structures both radiating and concentrically forming a spongy thick bone around a cavity of normal width filled with active marrow. The bone marrow of the newly formed bone was very vascular and fibrous, later, islands of fatty tissue as well as erythropoiesis and myelopoiesis were formed. When the central canal became filled with newly formed bone, numerous small islands of erythropoiesis and myelopoiesis were found scattered irregularly throughout the shaft, sometimes very close to the periosteum under the surface of the spongy new bone. In the advanced stages of calcification, only a little fibrous marrow was present, erythropoiesis and myelopoiesis were confined to the metaphysis.

In the third transmission of this disease the first leukemic marrows were found. They consisted of cell nests formed by lymphocytes. The leukemic infiltrations were more extensive in the parenchymal organs than in the bone marrow.

**Periosteal Lesions** Occurring independently or in combination with endosteal thickening of the shafts were periosteal proliferations of the same bones. First, a faint thickening of the periosteum was noted. Later, radiating spikes appeared concentrically, often with a feathery outline extending into the soft tissues. Gradually there developed first regular, later knobby or fungating osteophytes of bizarre

shape, formed by fine spongy bone which exceeded the original bone in thickness. On x-ray examination one could in most cases still recognize the outline of the original denser shaft under the superimposed new growth. The bony elements extended into the soft tissues, obliterating muscle and connective tissues. In the earlier stages a cotton-wool appearance might be seen in some areas. In the later stages, after the bone had become very dense, the lesions appeared more solid and have been compared to marble bones.

It appears that in advanced cases ring after ring of periosteal bone was laid down, leading to a great increase in the width of the bones without the formation of dense cortical layers as in the normal bone. This is clearly visible in photographs of cross sections of grossly enlarged bones. In these cases the marrow cavity is hardly reduced, in some cases it is even enlarged, particularly at the ends of the bones, and filled with active cellular marrow.

Microscopically, thickening and loosening of the periosteum were followed by layers of uncalcified osteoid tissue which were gradually converted into lamellar bone, with subsequent irregular calcification. The periosteum remained always visible, surrounding the periphery of the enlarged bone. Often calcifications and secondary bone formation were noted close to the periosteum but definitely separated from it in the overlying connective tissue and muscle. In a few instances this

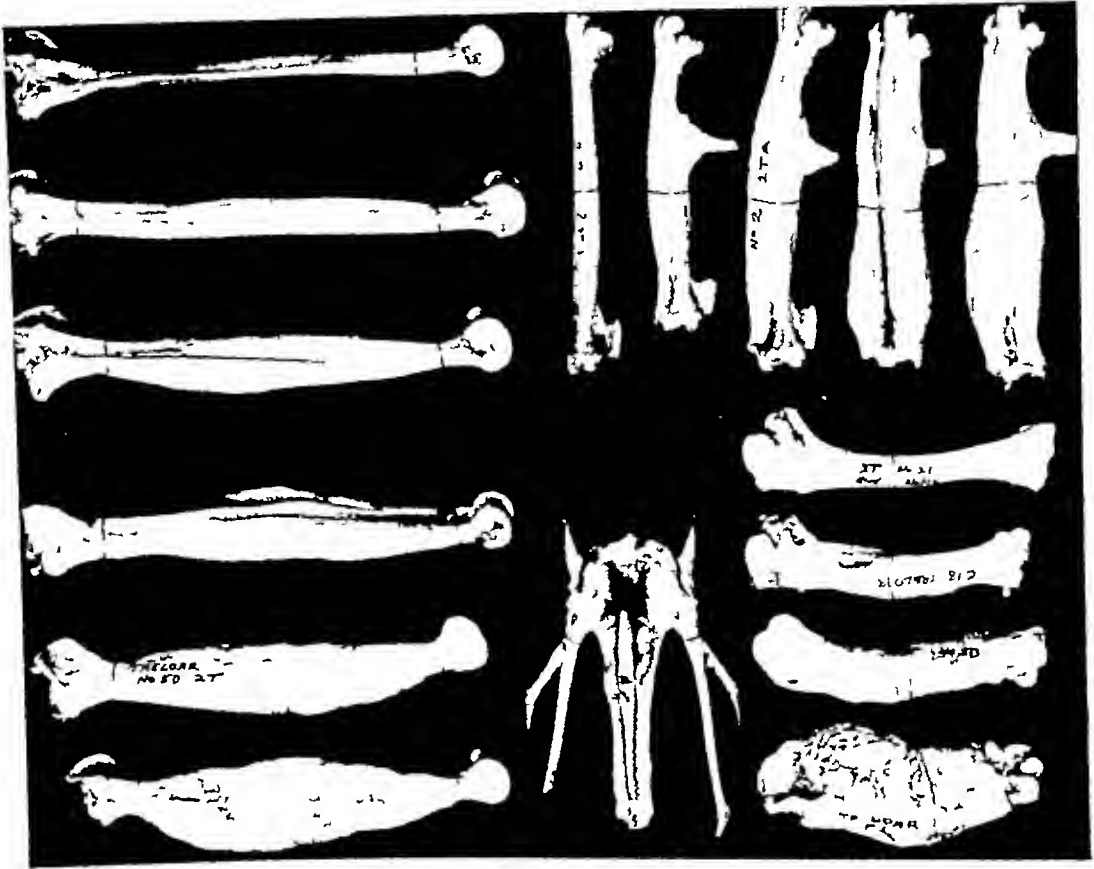


Fig 9 Humerus, tibia, and metatarsus of normal and osteopetrotic birds and petrotic sternum

extraosseous bone united finally with the periosteal bone, with disappearance of the periosteum over that small area

From the description of the endosteal and periosteal bony lesions and the corresponding pictures, two main features can easily be separated (1) the predominantly endosteal bone formation, with narrowing of the marrow cavity by cortical thickening of the central parts of the shafts, (2) the progressive hyperostosis with gross enlargement of the outline of the bones, but reducing the marrow in the later stages Both lesions tend to develop by secondary calcification into a solid osteopetrosis

#### DISCUSSION

*Differential Diagnosis* The lesions described resemble juvenile hyperostotic sclerosing osteopathia and only partly osteofibrosis cystica, Paget's disease marble bone, or osteogenic sarcoma They differ

from osteofibrosis cystica in the lack of real cyst formation with a fibrous wall Both Paget's and osteopetrosis show an osteofibrosis, mosaic structure of bone, endosteal and periosteal extension of bone and an increased alkaline phosphatase in the active phase of growth The lesions in the fowl, however, appear to develop further than Paget's disease in man They are always bilateral, involve numerous bones at the same time, appear as a generalized skeletal disease with a preference for the tubular bones, form in many cases a regular fine and delicate network of new bone, and have a tendency to late calcification and petrosis quite unlike Paget's disease They differ from marble bone predominantly in the extensive spiky osteophytes which begin to develop from the middle parts of the metaphysis and not from the ends The endosteal petrosis involves the central parts of the shaft and not the ends, the marrow

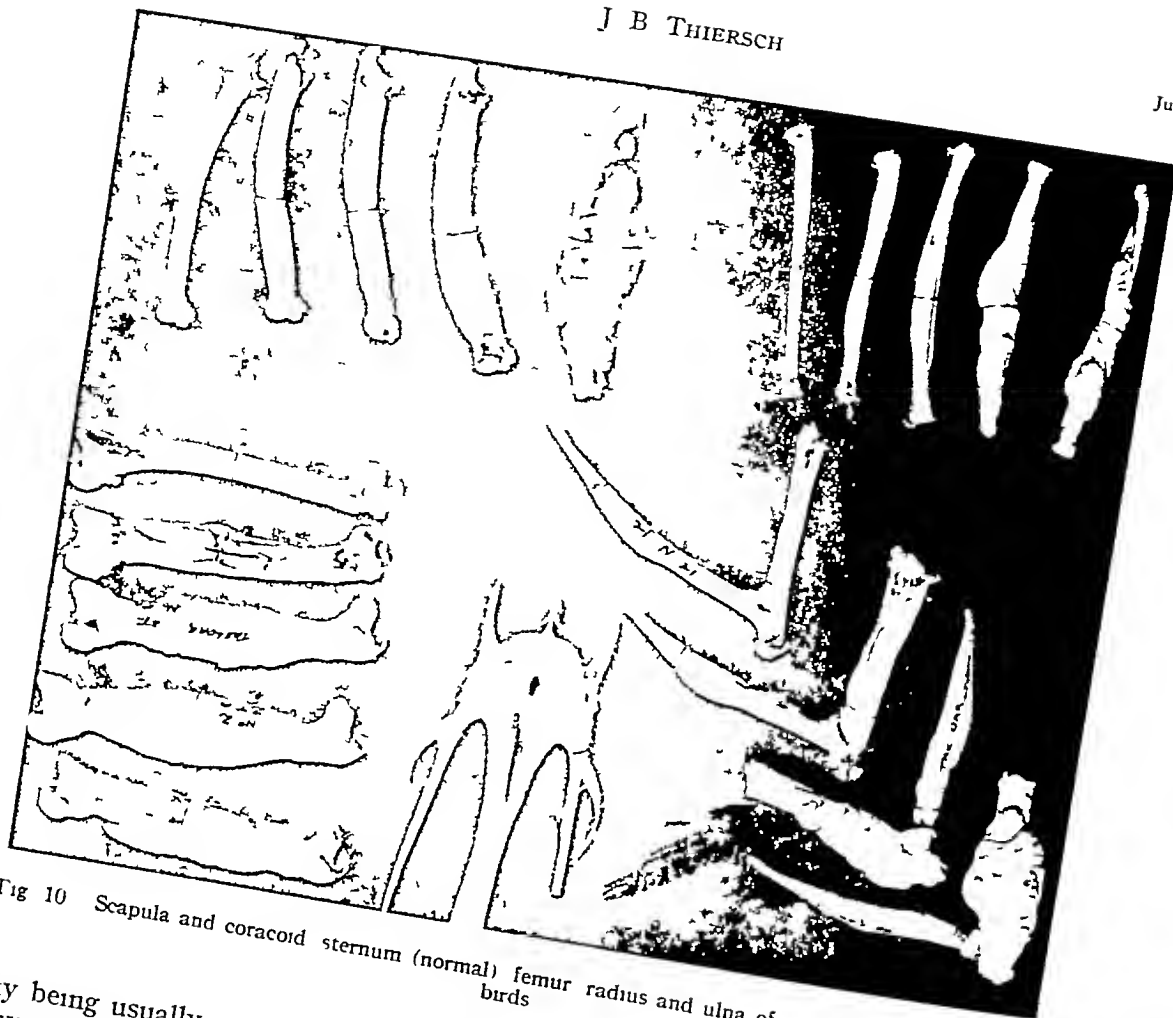


Fig 10 Scapula and coracoid sternum (normal) femur radius and ulna of normal and osteopetrotic birds

cavity being usually well preserved in the diaphysis in contrast to the sclerosed ends in marble bone. The chief points of difference from osteoplastic osteogenic sarcoma are the multiple origin of the lesions, their benign course, and periods of arrested growth, as well as absence of metastasis to the internal organs.

The experimental lesions in the fowls resemble closely Engelmann's description of a hyperostotic sclerosing infantile osteopathia with multiple lesions mainly involving tubular bones. Geschickter and Cope-land, in their book *Tumors of Bone* (Fig 521, p 805), show a picture of bones of a boy of seven with a dystrophy of unknown origin, closely resembling the lesions seen in birds.

To the variety of names already applied to this bone disease in fowls one could easily add another such as "transmissible

multiple juvenile hyperostotic sclerosing osteopathia" a shortened form, "transmissible osteopetrosis" might be more useful.

#### SUMMARY

- 1 The development of the bony lesions of "transmissible osteopetrosis" gallinarum is described and illustrated with serial roentgenograms and photographs.
- 2 The lesions were transmissible from fowl to chick with a shortening of the time of the development of the bony lesions from eight months to eight weeks.
- 3 During the active phase of the bone disease, the alkaline phosphatase was increased, the calcium content of the serum was normal.
- 4 The main lesions were a predominantly endosteal new bone formation (endostosis) and a predominantly periosteal

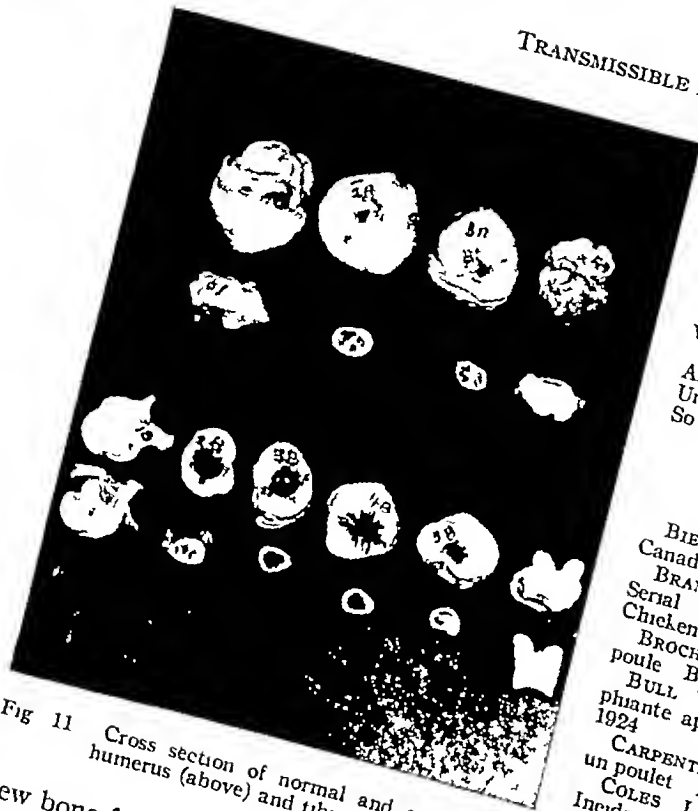


Fig 11 Cross section of normal and osteopetrotic humerus (above) and tibia (below)

new bone formation (hyperostosis) Both lesions developed into an osteopetrosis by subsequent calcification

5 The lesions resemble in part, but are not identical with, osteopetrosis cystica, Paget's disease, marble bone, and osteogenic sarcoma. They closely resemble a juvenile hyperostotic osteopathia described by Engelmann

6 The osteopetrosis in the experimental birds developed originally after chick embryos and one-day-old chicks were injected with human leukemic blood and material from a leukemic (Ak strain) mouse

7 Leukemic lesions of the internal organs were first seen in the osteopetrotic birds in the third transmission

Three hundred and six cockerel chickens injected with blood from six cases of Paget's disease, two cases of osteogenic sar-

coma, one case of Ewing's sarcoma, one case of Paget's sarcoma, one case of myeloma, and one case of carcinoma of the prostate with secondary deposits of the skeleton failed to show skeletal lesions within eight months of injection

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## REFERENCES

- BIELEY J A Note on Avian Osteopetrosis Canad J Compar Med 7 276 1943
- BRANDL C A, NELSON N M AND COTTRAL G E Serial Passage of Lymphomatosis-Osteopetrosis in Chickens Am J Vet Res 3 289 1942
- BROCHET L Ostéite hypertrophique chez la poule Bull Acad vet franç 88 194 and 977 1935
- BULL V, AND AUGER, L Ostéopathie hypertrophique apneumique Rev gén d méd vet 33 5, 1924
- CARPENTIER Osteopériostite hypertrophique chez un poulet Rec de méd vet 107 465 1931
- COLES J D AND BRONKHORST, J J Familial Incidence of Spontaneous Osteopetrosis gallinarum Onderstepoort J 21 79 1946
- EIDCKEN Quoted from Jungherr E The Avian Leukosis Complex in Diseases of Poultry by H E Biester and L Devries Iowa State College Press 1944 p 394
- ENGELMANN G Ein Fall von Osteopathia hyperostica (sclerotisans) multiplex infantilis Fortschr a d Geb d Röntgenstrahlen 39 1101 1929
- FURTH J Relation of Leukosis to Sarcoma of Chickens J Exper Med 63 127 145 1936
- GOSWAMI Knochenveränderungen bei experimenteller bei Hühnern erzeugter Osteodystrophia fibrosa Frankfurt Ztschr f Path 47 63 1935
- JUNGHERR E AND LANDAUER, W Studies on Fowl Paralysis 3 A Condition Resembling Osteopetrosis (Marble Bone) in Common Fowl Storrs Exp Station Bull 222, 1938
- PUGH L P Sporadic Diffuse Osteopériostitis of Fowls Vet Rec 7 189 1927
- REINHARDT R Die pathol anat Veränderungen bei den spontanen Krankheiten der Hausvögel Ergebn der allg Path u path Anat des Menschen u der Tiere 23 553 1930
- REIS J AND NOBREGA P Doenças des aves Instituto Biologica São Paulo Brasil 1936 p 417
- VENKATARAMAN R A Note on Osteitis Deformans in Two Fowls Indian J Vet Sc 6 108, 1936
- THIERSCH J B Attempts to Transmit Leukaemia of Man and of Mice to the Chick Embryo and to the Young Chick by the Amniotic and Intravenous Routes Australian J Exper Biol & M Sc 22 57 1944
- THIERSCH J B Attempts to Transmit Leukemia of Man to Animals with Special Reference to Osteopetrosis of the Fowl Proc Roy Austral Coll Phys 2 45 1947

Spanish summary on following page

## SUMARIO

## Aporte a la Radiología y Patología de la Osteopetrosis-Linfomatosis Aviana Transmisible

La inyección de materias leucémicas humanas y de materias procedentes de un ratón leucémico en los embriones de pollo y los pollos de un día dió por resultado lesiones esqueléticas—"osteopetrosis gallinácea"—que se transmitieron fácilmente al pollo con la sangre íntegra del ave adulta, a la vez que se acortaba el período de latencia, de 8 meses a 8 semanas. Durante el período activo de la osteopatía, se elevó la fosfatasa alcalina, el calcio sérico permaneció normal. Infiltraciones leucémicas de las vísceras fueron observadas por primera vez en las aves osteopetróticas en el tercer pase.

Las lesiones predominantes en el esqueleto consistieron en neosteogenia endo- y perióstica (endostosis e hiperostosis), con subsiguiente aparición de osteopetrosis a

consecuencia de la calcificación. Los huesos tubulares fueron los más afectados. La enfermedad se limitó casi completamente a la diáfisis, dejando intactos la epífisis y los extremos cartilaginosos.

La patología ósea se parecía en algunos sentidos, sin ser idéntica, a la de la osteopetrosis quística, la enfermedad de Paget, la fragilidad ósea de Albers-Schoenberg y el sarcoma osteógeno. También era muy semejante a la de la hiperosteopatía juvenil descrita por Engelmann.

Las inyecciones de sangre de pacientes con enfermedad de Paget, sarcoma osteógeno, sarcoma de Paget, mieloma y carcinoma prostático con metástasis óseas no provocaron lesiones esqueléticas en término de ocho meses en gallipollos.

# EDITORIAL

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## Pediatric X-Ray Diagnosis

Although x-rays were used in the diagnostic study of infants and children within a few weeks after Roentgen announced his discovery, the roentgen method has never been, and is not now being fully utilized in pediatrics. As early as 1898 Escherich commented that roentgen examinations were not being made as frequently in infants and children as in adults. In the United States prior to the first World War, roentgen facilities were non-existent in many large pediatric clinics, and, with few exceptions, both pediatricians and roentgenologists were then unfamiliar with the diagnostic value of the roentgen investigation of young patients.

Notwithstanding these adverse circumstances, roentgenology made early and substantial contributions to both the clinical and experimental investigation of the skeletal lesions of rickets, scurvy, and syphilis, and a number of other pediatric diseases. During the 1920's the great value of roentgen examination in the congenital obstructive lesions of the alimentary tract became manifest when their successful surgical treatment was demonstrated, largely owing to the pioneer efforts of Ladd of Boston. The diagnostic roentgen features of congenital hypertrophy of the pyloric muscle were reported in accurate detail for the first time by Meuwissen and Sloof of Holland in 1932. Reynolds of Detroit, in 1925, first described the roentgen changes in the skeletons of children suffering from Cooley's anemia, the skeletal lesion was one of the principal features which led to the recognition of Cooley's disease as a separate entity. During the 1930's excretory urography was introduced into the United States and it became clear immediately that this roentgen

technic would greatly ameliorate the study of chronic pyuria, long a difficult and important pediatric problem.

The roentgen method was also being gradually utilized more frequently in general pediatric diagnosis in a variety of ways, in the study of pulmonary diseases, infantile hydrocephalus, and many of the diseases of skeletal growth. In comparison with adult roentgenology, however, pediatric roentgenology was still a comparatively and seriously neglected subject. Infants and younger children were often incompletely examined or examined not at all, owing both to their inability to cooperate and to their actual resistance to roentgen examination. Most roentgenologists, busy with more pressing problems in adult medicine, had relatively little time to devote to the special diagnostic features and technical problems of pediatrics.

During the last decade pediatric roentgenology has expanded rapidly owing to several factors. Better roentgen images of infants and children are now more easily obtained with the faster exposures which can be made with the newer roentgen machines, now there are actually no serious difficulties in the examination of very young—even uncooperative—children and newly born infants. Pediatric roentgen examination has been greatly stimulated recently by the development of successful surgical treatment of several types of congenital heart disease. Notable contributions to roentgen diagnosis in this field have been made by Taussig of Baltimore in cyanotic heart disease, by Neuhauser of Boston in the compressing congenital lesions of the aortic arch and its branches, and by Castellanos of Havana in opaque angiocardiology.

One of the great deficiencies in pediatric roentgenology has been and still is the lack of satisfactory standards for the normal structures at different ages and for the normal ranges of variation in both morphology and function. This deficiency is gradually being lessened by careful roentgen studies of large groups of normal infants and children in clinics devoted to normal child development. Pediatricians and roentgenologists everywhere are indebted to Stuart and to Washburn and to Sontag for the many valid normal standards which they have established in their clinics at Boston, Denver, and Yellow Springs, respectively. One of the pioneers in roentgen study of the normal growing skeleton was the late Dr. T. Wingate Todd of Cleveland; his book on the developmental features of the bones of the hand still provides the most accurate estimate of skeletal maturation for older children. Only recently have we become acquainted with the normal emptying time of the infantile stomach and the normal pattern of the infantile small intestine and colon, in large part through the studies of Miller and Ostrum of Philadelphia and of Henderson of Pittsburgh. Satisfactory normal standards for the bone maturation of healthy living infants and children did not become available until they were established a few years ago by the investigations of Vogt and Vickers of Boston, Sontag of Yellow Springs, and Elgenmark of Norway.

The essential facts in pediatric roentgenology did not become available in a single text until 1945, when *Pediatric X-Ray Diagnosis* appeared. This was the first book published in English, dealing with the special problems of pediatric roentgen diagnosis since Rotch's pioneer work in 1910, *The Roentgen Ray in Pediatrics*.

During the last three years, two new infantile disorders, infantile cortical hyperostosis and premature bowing of the long bones, have been identified for the first time, principally through the findings at roentgen examination. The fact that two such conspicuous diseases could have re-

mained unrecognized for so long is an index of the great potential harvest of more adequate roentgen investigation of young patients in the future. It is now clear that infantile cortical hyperostosis is by no means a rare disease, having been widely misinterpreted in the past as scurvy, syphilis, leukemia, hematogenous osteomyelitis, and skeletal neoplasm. Its cause is unknown. In a few instances, patients with infantile cortical hyperostosis have ingested excessive amounts of percomorph oil and have improved dramatically when the oil was withdrawn. This has led to a consideration of hypervitaminosis A as a cause of the disease. Many patients, however, have never taken excessive amounts of percomorph oil and, in others, healing of the bone lesions has occurred notwithstanding the continued ingestion of large amounts of the oil. Prenatal bowing of the long bones, due to faulty packing and bending of the fetal extremities *in utero*, is characterized by a variety of patterns of bowing, twisting, and thickening of the fetal long bones. It is now clear that these congenital deformities of mechanical origin have often been confused in the past with rachitic deformities caused by deficiency of vitamin D.

The expansion of pediatric roentgenology and its increasing importance have been recognized by both of the major roentgen societies; symposiums on pediatric x-ray diagnosis were held by the American Roentgen Ray Society in September 1947, in Atlantic City, and by the Radiological Society of North America in November 1947, in Boston.<sup>1</sup> The Radiological Society is organizing a second symposium on pediatric roentgenology for the San Francisco meeting in 1948. Pediatricians also are, now more than ever before, interested in the roentgen method; pediatric x-ray diagnosis will be the subject of a two-day seminar to be held at the Annual Meeting of the Academy of Pediatrics in Atlantic City during November 1948.

<sup>1</sup> The papers constituting this Symposium appear in this issue of *Radiology*, pp. 1-43.

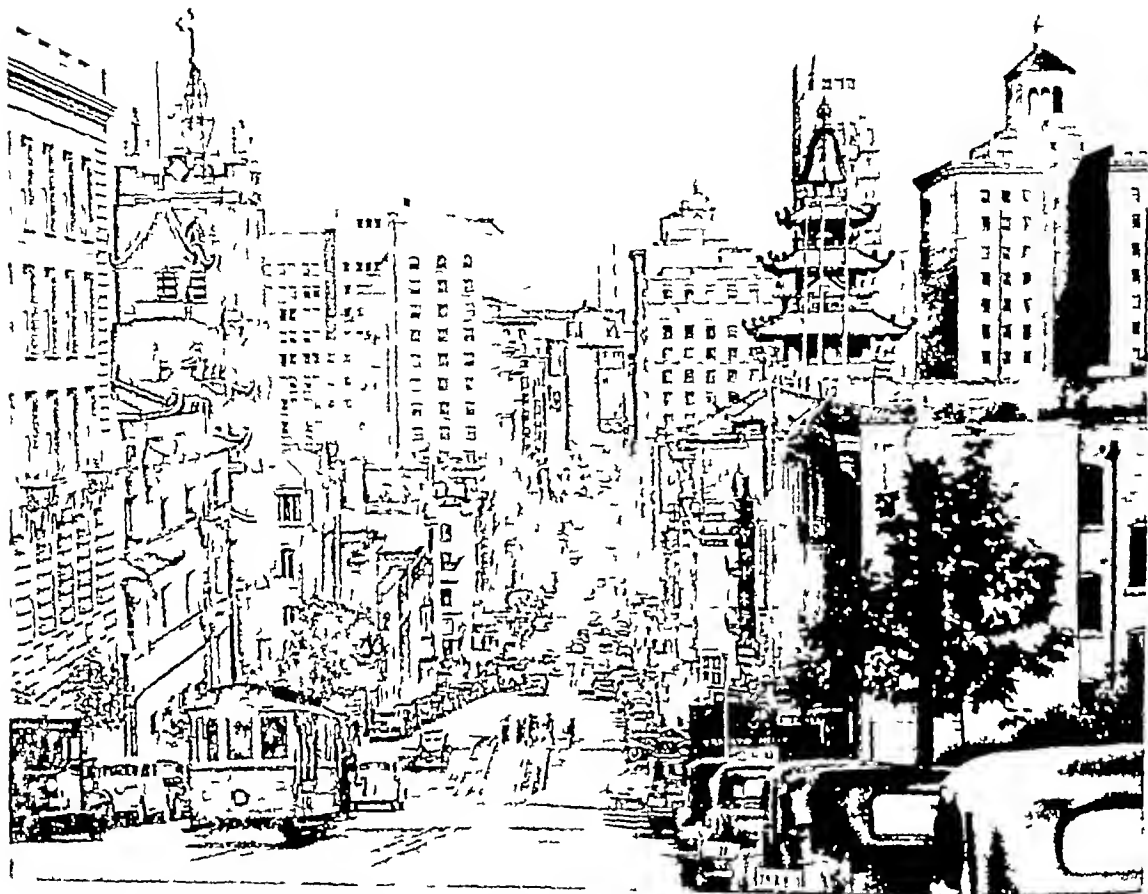
Owing to the rapid expansion of pediatric roentgenology, it has become necessary, in the larger clinics at least, for some members of the pediatric or roentgenological staffs to devote all or a large part of their time to the roentgen examination of infants and children. At the moment only a handful of physicians are especially skilled in pediatric x-ray diagnosis, but many men, both pediatricians and roentgenologists, are making a special study of pediatric roentgenology and some of these plan to limit their professional activities to this area of diagnosis. Pediatric roentgenology is now emerging as a medical specialty.

Current trends indicate that the interest in roentgen diagnosis in infants and children will continue to increase and the roentgen method will in the future enhance diagnosis and treatment in pediatrics to a degree comparable to that in adult medicine. If this be true, it follows naturally that pediatricians will look to the roentgenologists for more diagnostic help in the future. It also goes without saying that the roentgenologist of the future will devote more of his time to pediatric diagnosis and will become more skillful in the examination of young patients and more expert in the interpretation of their shadows.

JOHN CAFFEY, M D



Thirty-Fourth Annual Meeting—San Francisco



California Street near the Fairmont and Mark Hopkins Hotels headquarters for the December meeting, showing the cable cars which climb the hilly streets and in the background the San Francisco Oakland Bay bridge (Photograph by courtesy of San Francisco Convention and Tourist Bureau)

By this time every member of the Radiological Society of North America must know that the 1948 Annual Meeting is to be held in San Francisco, Dec 5 to Dec 10. Dr. Garland's official invitation appeared in *RADIOLOGY* for June. An outline of the Refresher Courses, the Scientific Program, and the Entertainment Program will be published in forthcoming issues. In the present reminder we wish again to stress the attractions of San Francisco, the convention city.

'It is easy to understand why no other American city has so inspired the imagination of writers,' says the leading article in *Holiday* for July. "There are temples to Confucius and Buddha, Spanish missions and the pagoda roofs of Chinatown. The waters of its bay are the blue-green color of the Mediterranean. The strong exciting sky line—'

But why quote more? You will, no doubt, want to read this article for yourself and enjoy its wealth of illustrations as a background for your week in the city.

It has been suggested that some of those attending the meeting may care to make post-convention trips to Hawaii or Mexico. Round trips to Hawaii, with seven to twelve days at the Royal Hawaiian Hotel range in cost from \$400 to \$750 per person (exclusive of Federal tax). Return to the Eastern United States *via* Mexico may be arranged by plane, train, or boat.

Members desiring further information about these special trips may write to Albert G. Albertson, Managing Director of Albertson Cruise Tours, 25 O'Farrell St., San Francisco.

## CENTRAL OHIO RADIOLOGICAL SOCIETY

At the recent election of officers of the Central Ohio Radiological Society, Dr Thurman R Fletcher of Columbus was chosen President and Dr Paul D Meyer of the same city Secretary-Treasurer

## GEORGIA RADIOLOGICAL SOCIETY

At the Annual Meeting of the Georgia Radiological Society, recently held in Atlanta, in conjunction with the State Medical Association of Georgia, the following officers were elected President, Dr H H McGee of Savannah, Vice-President, Dr Max Mass of Macon, Secretary-Treasurer, Dr Robert Drane of Savannah

## KANSAS RADIOLOGICAL SOCIETY

Kansas radiologists have recently formed a Kansas Radiological Society, with Dr Anthony F Rossitto of Wichita as Secretary Treasurer Meetings are to be held annually with the State Medical Society

## OKLAHOMA STATE RADIOLOGICAL SOCIETY

The Oklahoma State Radiological Society met on May 17 at the Skirvin Hotel, Oklahoma City The following officers were elected President, Dr P E Russo, Vice President, Dr H B Yagol, Secretary Treasurer, Dr W E Brown

## ROCKY MOUNTAIN RADIOLOGICAL SOCIETY

The Annual Meeting of the Rocky Mountain Radiological Society will be held in Salt Lake City, Aug 12-14 The program includes papers by Dr John D Camp of Rochester Minn, Dr Ross Golden of New York City Dr John Caffey of New York City Dr Wendell Scott of St Louis Dr L Henry Garland of San Francisco and other outstanding representatives of diagnostic and therapeutic radiology An interesting entertainment program has also been arranged

## TENNESSEE RADIOLOGICAL SOCIETY

The annual meeting of the Tennessee Radiological Society was recently held in conjunction with the State Medical Association Dr B R Kirklin was the guest speaker Dr A N Arneson of St Louis and Mr Mac Cahal Executive Secretary of the American College of Radiology were also guests at this meeting Dr Arneson and Dr Kirklin presented papers before the State Medical Society and

Mr Cahal was guest speaker at the President's banquet

The newly elected officers of the Tennessee Radiological Society are Dr Franklin B Bogart of Chattanooga, President, Dr Herbert Francis of Nashville, Vice-President, Dr J Marsh Frère of Chattanooga, Secretary-Treasurer

## COURSE IN CARDIAC ROENTGENOLOGY UNIVERSITY OF MINNESOTA

A course in Cardiac Roentgenology for radiologists will be offered at the Center for Continuation Study at the University of Minnesota, Oct 25 to 30, inclusive The participating faculty will be Dr Richard Bing of Baltimore, Md, Dr Fred Jenner Hodges of Ann Arbor, Mich, Dr Merrill Sosman of Boston, and Dr Marcy Sussman of New York In addition, the graduate faculty of the Mayo Foundation and the University of Minnesota will participate

Further information and application forms can be obtained from Dr George Aagaard, Director, Post-graduate Medical Instruction, University of Minnesota

## COURSE IN NUCLEAR PHYSICS UNIVERSITY OF CALIFORNIA

The University Extension Department of the University of California, in co operation with the University Medical Schools at San Francisco and Los Angeles, is presenting a course in Application of Nuclear Physics to the Biological and Medical Sciences, at The University of California, Los Angeles, Aug 2-Aug 20 The General Chairman is Stafford L Warren, M D, Professor of Biophysics and Dean of the School of Medicine (Los Angeles), and the Director of the course is Fred A Bryan, M D, Associate Professor of Medicine

Tuition for the complete course, including laboratory training is \$350, for the lecture series alone \$100 Enrollment is limited and applicants must present biographical data for official approval

## Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender Reviews will be published in the interest of our readers and as space permits

A SYMPOSIUM ON THE USE OF ISOTOPES IN BIOLOGY AND MEDICINE Report of a conference conducted at the University of Wisconsin Madison Wisconsin, September 1947, with contributions by nine-

teen leading scientists Published by the University of Wisconsin Press, Madison, Wis., 1948  
Price \$5.00

**DIE RÖNTGENDIAGNOSTIK DER WIRBELSÄULE UND IHRE GRUNDLAGEN** By DR. ADOLF LIECHTI, Professor of Radiology and Director of the Roentgen Institute, University of Berne Second revised and enlarged edition A volume of 364 pages, with 234 illustrations Published by Springer-Verlag, Vienna, 1948

## Book Reviews

**TEMPOROMANDIBULAR ARTHROGRAPHY** By FLEMING NØRGAARD Translated into English, from the Danish, by Hans Andersen, M.D. A volume of 188 pages of text and 31 full page plates containing 132 figures Einar Munksgaard, Copenhagen, 1947

The author presents a well written original work on the temporomandibular joint, advancing a new technic for the radiographic diagnosis of disease in this area. He reports 113 cases in which arthrography was performed, 25 of which were substantiated by surgical operation.

The normal anatomy of the region is reviewed, along with the previously accepted methods of roentgenography of the temporomandibular joint. A thorough description of the technic of arthrography, along with a discussion of the possible inconveniences and complications, is included. Interpretation of the normal and pathologic patterns is carefully described and the cases are analyzed, individually and collectively.

Dr. Nørgaard achieves a more concise diagnostic examination of the temporomandibular joint by injection of a radiopaque contrast medium into the upper and lower joint spaces, following injection of each space by roentgenographic examination. This allows the radiologist to prove or disprove the presence of a perforation of the meniscus, detachment of the meniscus, or obliteration of the joint spaces themselves. Correlation of the findings of such an examination with the surgeon's findings at operation are carefully noted, thereby proving the technic to be diagnostically accurate.

The volume is recommended highly to all radiologists who routinely study the temporomandibular joint and to all dentists and physicians who are interested in the diseases of this area.

## In Memoriam

DOROTHY MATTINGLY, M.D.

1915-1948

Dr. Dorothy Mattingly, the only native-born woman radiologist in Louisiana, died on April 23,



Dr. Dorothy Mattingly  
1915-1948

1948, in Tuscon, Ariz., while spending a vacation in the West. Dr. Mattingly was born in White Castle, Louisiana, in 1915, and was graduated from the Louisiana State University Medical School in 1936. She served her internship in the Charity Hospital of Louisiana, in New Orleans, and spent three years as a resident in Radiology in the same institution. Her brilliant mind, her interest in research, and her genteel and cultured manner endeared her to the entire staff, and especially to the writer.

Having completed her residency, Dr. Mattingly practised her profession in Baton Rouge, where she became well known for her outstanding ability as a radiologist, and also for her civic and charitable work. She was a member of the East Baton Rouge Medical Society, Louisiana State Medical Society, the American Medical Women's Association, and the American Medical Association. She was a diplomate of the American Board of Radiology and a member of the Radiological Society of North America. She served efficiently as a staff member of Our Lady of the Lake Sanitarium and the Baton Rouge Hospital. While her contributions to the radiological literature were not voluminous, they were of the highest order. Her papers on "Renal Rickets" and "Abdominal Pregnancy" are outstanding examples of her ability as a radiologist and a medical writer.

Dr. Mattingly was a quiet, reserved lady, who inspired confidence both in her patients and her associates. The application of radiology to the practice of medicine was to her a matter of vital interest. Our specialty sustains a real loss in her death.

LEON J. MENVILLE, M.D.

# RADIOLOGICAL SOCIETIES SECRETARIES AND MEETING DATES

*Editor's Note* Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to date by notifying the editor promptly of changes in officers and meeting dates

## UNITED STATES

**RADIOLOGICAL SOCIETY OF NORTH AMERICA** *Secretary-Treasurer*, Donald S Childs, M D, 607 Medical Arts Bldg, Syracuse 2, N Y

**AMERICAN RADIUM SOCIETY** *Secretary*, Hugh F Hare, M D, 605 Commonwealth Ave, Boston 15, Mass

**AMERICAN ROENTGEN RAY SOCIETY** *Secretary*, Harold Dabney Kerr, M D, Iowa City, Iowa

**AMERICAN COLLEGE OF RADIOLOGY** *Secretary*, Mac F Cahal, 20 N Wacker Dr, Chicago 6, Ill

**SECTION ON RADIOLOGY, A M A** *Secretary*, U V Portmann, M D, Cleveland Clinic, Cleveland 6, Ohio

## Alabama

**ALABAMA RADIOLOGICAL SOCIETY** *Secretary-Treasurer*, Courtney S Stickley, M D Bell Bldg, Montgomery Next meeting with State Medical Association

## Arkansas

**ARKANSAS RADIOLOGICAL SOCIETY** *Secretary*, Fred Hames, M D, Pine Bluff Meets every three months and at meeting of State Medical Society

## California

**CALIFORNIA MEDICAL ASSOCIATION SECTION ON RADIOLOGY** *Secretary*, Sydney F Thomas, M D, Palo Alto Clinic Palo Alto

**LOS ANGELES RADIOLOGICAL SOCIETY** *Secretary*, Moris Horwitz M D, 2009 Wilshire Blvd, Los Angeles 5 Meets second Wednesday of each month at County Society Bldg

**NORTHERN CALIFORNIA RADIOLOGICAL CLUB** *Secretary*, Charles E Grayson, M D Medico Dental Bldg Sacramento 14 Meets at dinner last Monday of September, November, January, March, and May

**PACIFIC ROENTGEN SOCIETY** *Secretary* L Henry Garland M D, 450 Sutter St, San Francisco 8 Meets annually with State Medical Association

**SAN DIEGO ROENTGEN SOCIETY** *Secretary* R F Niehaus, M D, 1831 Fourth Ave, San Diego Meets first Wednesday of each month

**X-RAY STUDY CLUB OF SAN FRANCISCO** *Secretary*, Ivan J Miller, M D, 2000 Van Ness Ave. Meets monthly on the third Thursday at 7 45 P M, January to June at Lane Hall, Stanford University Hospital, and July to December at Toland Hall University of California Hospital

## Colorado

**DENVER RADIOLOGICAL CLUB** *Secretary*, Mark S Donovan, M D, 306 Majestic Bldg, Denver 2 Meets third Friday of each month, at the Colorado School of Medicine and Hospitals

## Connecticut

**CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY** *Secretary* Robert M Lowman, M D

Grace-New Haven Hospital, Grace Unit, New Haven Meetings bimonthly, second Thursday

## District of Columbia

**RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY** *Secretary*, Alfred A J Den, M D, 1801 K St, N W, Washington 6 Meets third Thursday, January, March, May, and October, at 8 00 P M, in Medical Society Auditorium

## Florida

**FLORIDA RADIOLOGICAL SOCIETY** *Secretary-Treasurer*, J A. Beals, M D St Luke's Hospital, Jacksonville Meets in April and in November

## Georgia

**GEORGIA RADIOLOGICAL SOCIETY** *Secretary-Treasurer*, Robert Drane, M D, De Renne Apartments, Savannah Meets in November and at the annual meeting of State Medical Association

## Illinois

**CHICAGO ROENTGEN SOCIETY** *Secretary*, T J Wachowski, M D, 310 Ellis Ave, Wheaton Meets at the Palmer House, second Thursday of October, November January, February, March, and April, at 8 00 P M

**ILLINOIS RADIOLOGICAL SOCIETY** *Secretary-Treasurer*, William DeHollander, M D, St Johns' Hospital Springfield Meetings quarterly as announced

**ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY** *Secretary*, John H Gilmore, M D, 720 N Michigan Ave Chicago 11

## Indiana

**INDIANA ROENTGEN SOCIETY** *Secretary-Treasurer* J A Campbell, M D, Indiana University Hospitals Indianapolis 7 Annual meeting in May

## Iowa

**IOWA X-RAY CLUB** *Secretary* Arthur W Erskine M D, 326 Higley Building, Cedar Rapids Meets during annual session of State Medical Society

## Kansas

**KANSAS RADIOLOGICAL SOCIETY** *Secretary Treasurer*, Anthony F Rossitto M D, Wichita Hospital Wichita Meets annually with State Medical Society

## Kentucky

**KENTUCKY RADIOLOGICAL SOCIETY** *Secretary-Treasurer* Sydney E Johnson M D 101 W Chestnut St Louisville

**LOUISVILLE RADIOLOGICAL SOCIETY** *Secretary-Treasurer*, Everett L Pirley, Louisville General Hospital Louisville 2 Meets second Friday of each month at Louisville General Hospital

## Louisiana

LOUISIANA RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Johnson R. Anderson M D, No Louisiana Sanitarium, Shreveport Meets with State Medical Society

ORLEANS PARISH RADIOLOGICAL SOCIETY *Secretary* Joseph V Schlosser, M D, Charity Hospital of Louisiana New Orleans 13 Meets first Tuesday of each month

SHREVEPORT RADIOLOGICAL CLUB *Secretary*, Oscar O Jones, M D, 2622 Greenwood Road Meets monthly September to May, third Wednesday

## Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION *Secretary*, J Howard Franz, M D 1127 St Paul St, Baltimore 2

## Michigan

DETROIT X-RAY AND RADIUM SOCIETY *Secretary-Treasurer*, E R Witwer M D, Harper Hospital, Detroit 1 Meetings first Thursday October to May, at Wayne County Medical Society club rooms

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS *Secretary-Treasurer* R B MacDuff M D 220 Genesee Bank Building, Flint 3

## Minnesota

MINNESOTA RADIOLOGICAL SOCIETY *Secretary*, C N Borman, M D, 802 Medical Arts Bldg, Minneapolis 2 Meets in Spring and Fall

## Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY *Secretary*, Wm M Kitchen M D, 1010 Rialto Building Kansas City, 6 Mo Meetings last Friday of each month

ST LOUIS SOCIETY OF RADIOLOGISTS *Secretary*, Edwin C Ernst, M D, 100 Beaumont Medical Bldg Meets on fourth Wednesday October to May

## Nebraska

NEBRASKA RADIOLOGICAL SOCIETY *Secretary Treasurer*, Ralph C Moore, M D, Nebraska Methodist Hospital, Omaha 3 Meets third Wednesday of each month at 6 P M in Omaha or Lincoln

## New England

NEW ENGLAND ROENTGEN RAY SOCIETY *Secretary-Treasurer*, George Levene, M D, Massachusetts Memorial Hospitals, Boston Meets monthly on third Friday at Boston Medical Library

## New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY *Secretary-Treasurer* Albert C Johnston M D, Elliot Community Hospital Keene. Meetings quarterly in Concord

## New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY *Secretary* Raphael Pomeranz M D, 31 Lincoln Park Newark 2 Meetings at Atlantic City at time of State Medical Society and midwinter in Newark

## New York

ASSOCIATED RADIOLOGISTS OF NEW YORK INC *Secretary* William J Francis, M D, East Rockaway

BROOKLYN ROENTGEN RAY SOCIETY *Secretary-Treasurer* Abraham H Levy, M D, 1354 Carroll St, Bklyn 13 Meets fourth Tuesday of every month, October to April

BUFFALO RADIOLOGICAL SOCIETY *Secretary-Treasurer* Mario C Gian, M D, 610 Niagara St, Buffalo 1 Meetings second Monday, October to May

CENTRAL NEW YORK ROENTGEN SOCIETY *Secretary-Treasurer*, Dwight V Needham, M D, 608 E Genesee St, Syracuse 10 Meetings in January, May, and October

LONG ISLAND RADIOLOGICAL SOCIETY *Secretary*, Marcus Wiener, M D, 1430 48th St, Brooklyn 19 Meetings fourth Thursday evening, October to May at 8 45 P.M., in Kings County Medical Bldg

NEW YORK ROENTGEN SOCIETY *Secretary* Wm Snow, M D, 941 Park Ave New York 28

QUEENS ROENTGEN RAY SOCIETY *Secretary* Jacob E Goldstein M D 88-29 163rd St, Jamaica 3 Meets fourth Monday of each month

ROCHESTER ROENTGEN-RAY SOCIETY *Secretary* Murray P George, M D, 260 Crittenden Blvd, Rochester 7 Meets at Strong Memorial Hospital, third Monday, September through May

## North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA *Secretary-Treasurer* James E Hemphill, M D, Professional Bldg, Charlotte 2 Meets in May and October

## North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY *Secretary* Charles Heilman M D, 1338 Second St, N Fargo

## Ohio

OHIO STATE RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Carroll Dundon M D 2065 Adelbert Road, Cleveland 6 Next meeting at annual meeting of the State Medical Association

CENTRAL OHIO RADIOLOGICAL SOCIETY *Secretary* Paul D Meyer M D Grant Hospital Columbus Meets second Thursday, October December February April, and June 6 30 P M Seneca Hotel Columbus

CINCINNATI RADIOLOGICAL SOCIETY *Secretary*, Eugene L Saenger, M D, 735 Doctors Bldg, Cincinnati 2 Meets last Monday, September to May

CLEVELAND RADIOLOGICAL SOCIETY *Secretary-Treasurer*, George L Sackett, M D, 10515 Carnegie Ave, Cleveland 6 Meetings at 6 30 P.M. on fourth Monday, October to April inclusive

## Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY *Secretary-Treasurer*, W E Brown, M D, 411 Medical Arts Bldg Tulsa Meetings three times a year

## Oregon

OREGON RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Wm Y Burton, M D, 242 Medical Arts Bldg, Portland 5 Meets monthly on the second Wednesday, at 8 00 P M in the library of the University of Oregon Medical School

## Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Sydney J Hawley, M D, 1320 Madison St, Seattle 4, Wash Meets annually in May

## Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY *Secretary-Treasurer*, James M Converse M D 416 Pine St, Williamsport 8 Meets annually  
 PHILADELPHIA ROENTGEN RAY SOCIETY *Secretary*, Arthur Finkelstein, M D, Graduate Hospital Philadelphia Meets first Thursday of each month at 8 00 P M, from October to May in Thomson Hall, College of Physicians, 21 S 22d St  
 PITTSBURGH ROENTGEN SOCIETY *Secretary-Treasurer*, R P Meader, M D, 4002 Jenkins Arcade Pittsburgh 22 Meets second Wednesday of each month at 6 30 P M, October to June

## Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Maurice D Frazer, M D, Lincoln Clinic, Lincoln Nebr

## South Carolina

SOUTH CAROLINA X-RAY SOCIETY *Secretary-Treasurer*, Robert B Taft, M D, 103 Rutledge Ave Charleston 16

## Tennessee

MEMPHIS ROENTGEN CLUB Meetings second Tuesday of each month at University Center  
 TENNESSEE RADIOLOGICAL SOCIETY *Secretary-Treasurer*, J Marsh Frère, M D 707 Walnut St Chattanooga Meets annually with State Medical Society in April

## Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB *Secretary*, X R Hyde, M D, Medical Arts Bldg Fort Worth 2 Meetings on third Monday of each month in Dallas in the odd months and in Fort Worth in the even months  
 HOUSTON X-RAY CLUB *Secretary*, Curtis H Burge, M D, 3020 San Jacinto Houston 4 Meetings fourth Monday of each month  
 TEXAS RADIOLOGICAL SOCIETY *Secretary-Treasurer*, R P O'Bannon, M D 650 Fifth Ave, Fort Worth 4 Next meeting Jan 7-8 1949

## Utah

UTAH STATE RADIOLOGICAL SOCIETY *Secretary-Treasurer*, M Lowry Allen, M D, Judge Bldg, Salt Lake City 1 Meets third Wednesday, January, March, May, September, November  
 UNIVERSITY OF UTAH RADIOLOGICAL CONFERENCE *Secretary*, Henry H Lerner, M D Meets first and third Thursdays, September to June, inclusive, at Salt Lake County General Hospital

## Virginia

VIRGINIA RADIOLOGICAL SOCIETY *Secretary*, P B Parsons, M D, Norfolk General Hospital, Norfolk 7

## Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY *Secretary-Treasurer* Homer V Hartzell, M D, 310 Stimson Bldg, Seattle 1 Meetings fourth Monday October through May at College Club Seattle

## Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY *Secretary-Treasurer*, A Melamed, M D, 425 E Wisconsin Ave, Milwaukee 2 Meets monthly on second Monday at the University Club  
 RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY *Secretary* S R Beatty, M D, 185 Hazel St, Oshkosh Two-day meeting in May and one day with State Medical Society September  
 UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE Meets first and third Thursdays 4 P M, September to May Service Memorial Institute Madison 6

## Puerto Rico

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA —*Secretary*, Jesus Rivera Otero M D Box 3524, Santurce Puerto Rico

## CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS *Honorary Secretary-Treasurer* E M Crawford, M D, 2100 Marlowe Ave., Montreal 28, Quebec Meetings in January and June.  
 LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES *General Secretary*, Origène Dufresne, M D, Institut du Radium, Montreal Meets third Saturday each month

## CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA Offices in Hospital Mercedes, Havana Meets monthly

## MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPIA *General Secretary* Dr Dionisio Pérez Cosío Marsella 11, México D F Meetings first Monday of each month

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## ROENTGEN DIAGNOSIS

### THE HEAD AND NECK

**Technique of Direct (Percutaneous) Cerebral Angiography** E Lindgren Brit J Radiol 20 326-331, August 1947

Three problems claim attention in percutaneous cerebral angiography roentgen technic, puncture technic and the opaque medium used. The procedure should be performed with the head in marked hyperextension. This assists in immobilizing the artery and the soft tissues of the neck.

To simplify roentgen technic a special apparatus is used so that films may be made without changing the position of the head. This consists of two special cassette holders one, beneath the head, accommodates two cassettes and the other perpendicular to this, at one side of the head contains three. The tube is mounted on an arc so it may be shifted quickly for lateral and anteroposterior exposures.

The puncture is made under local anesthesia, 1 per cent novocain without epinephrine being given subcutaneously. The puncture needle is inserted as high as possible. This is usually near the bifurcation or into the internal carotid. A sharp needle should be used as a dull one is apt to make the artery roll. Occasionally the external carotid will be entered. When this happens, the puncture is repeated lower down. After the artery is entered the needle is connected to a rubber tube. If the tube is not transparent, a glass connector should be included, so that the level of the blood may be easily observed. After the needle is in position a syringe of normal saline is connected to the tube and saline is run through the needle at intervals to prevent clotting.

Umbraclil in 35 or 50 per cent solution is used instead of thorotrast. This causes some transient irritation with symptoms of pain or burning. These symptoms, however, are of assistance in determining whether or not the dye is entering the internal carotid. If the pain is in the eye, the dye is entering the internal carotid, if the pain is in the jaws, it is entering the external. About 9 c.c. are injected in two or three seconds. No compression of the veins is used.

No attempt is made to take anteroposterior and lateral films simultaneously as this requires special apparatus and the films are apt to lack contrast.

The author's technic had been used in 153 patients with unsatisfactory results in only 4 instances.

SIDNEY J. HAWLEY, M.D.

**Cerebral Angiography A Technique Using Dilute Diodrast.** Franc D. Ingraham and Cully A. Cobb Jr J Neurosurg 4 422-434, September 1947

When large quantities of a concentrated solution of diodrast are used for cerebral angiography, reactions attributable to the hypertonicity of the solution may occur. To obviate these reactions two or more injections of 10 c.c. of 35 per cent diodrast have been used by the authors. The only unusual instrument required is a special angiogram needle which greatly simplifies the critical stage of injection. This is a number 18 needle having a curve of about 60 degrees with its bevel on the outer side of the curve. A rounded shoulder 4 mm. above the opening is placed eccentrically so that its plane of contact with the artery when the needle is in place is at an angle of about 45 degrees. This allows the

shoulder to form a tight seal and to prevent the needle from advancing into the artery, yet without damaging the vessel wall. In 25 successive operations in patients ranging in age from 2 to 67 years, the diagnostic quality of the films was satisfactory in all but 2, positive findings were frequent, and there were no undesirable effects. Several injections may be made for stereoscopic arteriograms, for anteroposterior projection, and for demonstration of two or more of the four arterial networks of the brain.

**An Additional Approach to the Internal Carotid Artery for Cerebral Angiography** Arthur Ecker and Richard H. Chamberlain J Neurosurg 4 444-450, September 1947

In the performance of cerebral angiography the authors first attempt percutaneous injection of the common carotid artery. If this is unsuccessful they feel that percutaneous injection of the internal carotid should then be tried. Should this method also be unsatisfactory direct exposure of the carotid is employed. A method for performing cerebral angiography by direct percutaneous injection of the internal carotid artery at the base of the skull with the use of local anesthesia is described.

Percutaneous injection of the internal carotid artery offers some advantages and suffers some disadvantages over other methods. Among its disadvantages may be listed lack of visualization of the artery, probable contraindication of thorotrast as a contrast medium because of the dangers of extravasation, not infrequent inability to penetrate the artery and maintain the position of the needle in certain patients and the possible difficulty of working so close to other structures as the extension of the subarachnoid space, cranial nerves and eustachian tube communicating with the middle ear. There is also the remote possibility of the production of an arteriovenous fistula between the internal carotid artery and internal jugular vein. When one is seeking information concerning a possible meningioma which may have a double arterial blood supply, it may be more desirable to inject the common carotid artery.

The advantages of the method are the use of a low-concentration contrast medium, with reduced total amount of medium employed, the direct injection into the internal carotid artery, the ease and accuracy of multiple injections, the possibility of use in short-necked patients in whom lower percutaneous injection is difficult especially when there is a low bifurcation of the common carotid artery, and the other advantages shared with percutaneous methods in general.

**Intracranial Osteochondroma** Robert W. Forsythe, George S. Baker, Malcolm B. Dockerty, and John D. Camp Proc Staff Meet, Mayo Clin 22 350-354, Aug 20 1947

The authors present a case of intracranial osteochondroma and discuss a previously reported case, published in 1932 (Verbrugghen and Learmonth J Nerv & Ment Dis 76 463 1932). In this latter case the tumor arose from the falx cerebri and contained cartilaginous elements. Thirty-eight cases of primary solitary intracranial tumors of cartilaginous structure had been reported in the literature up to the date of this paper.

In the authors' case, first seen in September 1939 the chief complaints were nocturia dysuria, frequency of micturition perineal pain extending into both legs, backache and occasional headache. It is not stated whether the skull was examined at that time. Seven years later the patient returned, complaining of fatigue, generalized aching and occasional stiffness of the fingers. He gave a history of chills and fever on two occasions. Roentgenograms of the skull at this time revealed a large calcified intracranial mass in the posteroparietal area. There was a history of injury in 1945 with no residual effect on the headaches. Tinnitus had been noted in August 1940. Neurological examination was negative except for postural vertigo and a grade I tremor of the hands. Diagnosis rested between a meningioma and a calcified hematoma. The tumor was removed in September 1946 and reported as osteochondroma.

The discussion following this report contains an excellent summary of the pathology of intracranial chondromas with special reference to their source of origin, namely (1) from the sphenoid ethmoid, and occipital bones, (2) the choroid plexus (3) the dura, and (4) the arachnoid. The radiographic characteristics of osteochondroma are also reviewed in the discussion and the similarity between meningioma and osteochondroma is considered.

[Both the cases presented in this article had a long history of cerebral symptoms. They emphasize the value of periodic follow up examinations in cases of suspected intracranial tumor.—R. C. P.]

ROBERT C. PENDERGRASS, M.D.

**Cysticercosis of the Brain. Clinical, Pathological, Radiological and Cerebrospinal Fluid Findings.** Paulo Pinto Pupo, Waldemar Cardoso, João Batista dos Reis, and Celso Pereira da Silva. *Arq. assist. psicopat. estad. São Paulo* 10-11: 3-123, January-December 1945-46.

Twenty-six cases of cysticercosis involving the brain are reviewed. Some of the patients were followed for years, routine tests for neurocysticercosis being performed at intervals. Ten of the 26 cases came to necropsy.

Encephalic cysticercosis is not rare in psychiatric hospitals in Brazil. Convulsions and mental deterioration are the most frequent clinical findings, due to the predilection of the *Cysticercus* for the meninges and cortex. Sometimes the clinical picture, without intracranial hypertension, suggests brain tumor and the differential diagnosis is difficult.

Examination of the spinal fluid is of the utmost importance. Pleocytosis with eosinophilia, slight increase in proteins especially the globulins, alteration in the colloidal benzoin curve in the first or first and mid zones, positive *Cysticercus* complement-fixation test, with negative Wassermann reaction compose the complete cerebrospinal fluid syndrome. This set of alterations was detected in 13 of the 21 patients examined clinically.

Seventeen patients in the series had radiologic examinations. Evidence of calcified *Cysticercus* was found in 6. 3 patients had multiple calcified nodules and 3 single nodules. Five of these 6 patients had convulsions. In 3 patients the roentgen signs pointed toward brain tumor, 2 of this number had increased intracranial pressure. Pneumoencephalography and ventriculography added no information except that

hydrocephalus internus was detected in 2 of the patients. In the remaining 8 patients the roentgen examination was non-contributory. Of the 13 patients with spinal fluid findings suggestive of cysticercosis, 4 were found to have calcified nodules on roentgen examination and one had signs of increased intracranial pressure. In 2 cases with calcified *Cysticercus* seen radiologically the spinal fluid was normal in one and in the other showed hypercytosis.

A number of roentgenograms are reproduced.

**Acrocephalosyndactyly.** H. Gray and L. B. Dickey. *Am. J. Dis. Child.* 74: 213-217, August 1947.

A case of acrocephalosyndactyly associated with cleft palate, parrot nose (psittacorhinia), and exophthalmos is reported. The roentgenographic findings were those of a high vault, premature partial synostosis of the coronal suture and an apparently accessory partially open coronal suture running through the parietal bone. The anterior fossa was short and flat. The middle fossa was extremely deep and larger than normal. The posterior fossa was short and the lambdoid and sphenoccipital sutures were open. Lacunae were seen in the middle and posterior portions of the vault. Syndactyly was also present.

Cohn, who reported a case of similar type (*Am. J. Surg.* 68: 93, 1945; *Abst. in Radiology* 46: 294, 1946) placed the total number of authenticated examples at about 80.

P. NEMPAKOS, M.D.

**Simmonds' Cachexia and Diabetes Insipidus.** Werner Koella. *Schweiz. med. Wchnschr.* 77: 1023-1027, Sept. 27, 1947.

The combined occurrence of diseases of hypophyseal-dienecephalic genesis is no rarity. A search of the literature, however, showed only three cases in which Simmonds' disease and diabetes insipidus were coexistent. The present report deals with a fourth case in an 8-year-old girl. In addition to the two syndromes, she had a right-sided ophthalmoplegia and later became blind in the right eye. Encephalographic study about a year after onset showed a tumor of the floor of the third ventricle, considered inoperable because of its location. Hormone substitution therapy led to marked improvement in the diabetes insipidus and x-ray therapy (1400 r to each side of the head) led to partial restoration of sight in the right eye and improvement in the paralysis with a gain of 16 kg in weight. A short time later the condition again deteriorated, hypoglycemia developed, and death occurred about a year and a half after onset. Hypothermia was never observed in this patient as a rule the temperature was subfebrile.

LEWIS G. JACOBS, M.D.

## THE CHEST

**Radiologic Anatomy of the Lung.** P. Chatton and A. Maleki. *J. de radiol. et d'électrol.* 28: 285-310, 1947.

Advances in pulmonary surgery have required a more extensive knowledge of the segmental anatomy of the lung. The authors review the radiologic anatomy of the lung in great detail in an article illustrated by excellent plates.

Each lung has a principal air passage, the stem bronchus, which extends from the hilum to the inferoposterior portion of the organ. The zonal (segmental) bronchi arise from this main bronchus either singly or

in groups, from trunks of common origin. The majority of these, twelve in number, do not leave the sagittal plane of the stem bronchus and are best examined in the lateral projection. They are as follows: 1 apical bronchus, 5 ventral bronchi, 5 dorsal bronchi, 1 internal parabronchus.

The remaining zonal bronchi (the five external parabronchi) extend laterally in a plane perpendicular to the stem bronchus and are best visualized in the postero-anterior view.

The arterial supply parallels the bronchial tree, to which it is closely linked segment by segment.

For each zonal bronchovascular pedicle, there is a corresponding pulmonary segment of conical or pyramidal shape. The summit of this segment is at the origin of the pedicle, while its base borders on the periphery of the thorax (costochondral or diaphragmatic surfaces).

The authors discuss the identification of the various bronchovascular zones and their subdivisions by means of bronchography and tomography. The value of tomography is particularly stressed because of the information which can be obtained without artificial means, i.e., without instillation of a radiopaque substance into the tracheobronchial tree.

Pathologic opacification of a segment, by atelectasis or by a segmental pneumonitis ("zonitis") manifests itself on the film by findings which can be interpreted by combined study of the standard postero-anterior and lateral projections. Examples of consolidation of the various segments are shown.

RODERICK L. TONDREAU, M.D.

**Bronchographic Study of 555 Cases with Special Reference to Bronchiectasis.** Herbert W. Schmidt. *Ann. Otol., Rhin. & Laryng.* 56: 793-803, September 1947.

This report is based on a series of bronchographic studies of military personnel seen at an army general hospital in an eleven-month period. This is a selected group of patients since prior to the entrance into military service all had passed a physical examination and most of them had had roentgenograms of the thorax. At some time in their military career, symptoms referable to the bronchial tree had developed, of sufficient severity to require hospitalization.

The bronchographic studies were preceded in every case by complete physical examination, chest roentgenography, sputum studies and bronchoscopy. After postural drainage to rid the bronchial tree of secretion the iodized oil (Ipidol or Iodochlorol) was introduced by the intratracheal catheter method. Twenty cubic centimeters were instilled into the right bronchial tree, following which anteroposterior, right lateral and right oblique roentgenograms were taken. The procedure was then repeated on the left. Cocaine hydrochloride was used as the anesthetic agent. It was required that all the bronchopulmonary segments be completely filled by the opaque medium.

A total of 555 bilateral bronchographic studies were performed. In 247 the findings were positive. Evidence of non-tuberculous bronchiectasis was obtained in 158 cases. The right upper lobe was involved 18 times, the right middle lobe 28 times, the right lower lobe 72 times, the entire left upper lobe 9 times, the lingula 39 times, the left lower lobe 98 times. In almost every instance it was believed that the bronchiectasis had been present at the time the patient was inducted into the

service. Four cases of situs inversus viscerum were found all in association with bronchiectasis. Other positive findings included congenital anomalies of the bronchial tree, a cavity due to coccidioidomycosis, cystic lesions of the lung, and abscesses.

The author points out the value of bronchographic studies after segmental resection or lobectomy to determine what has happened to the remaining portion of the bronchial tree. He cites two cases in which long lingular bronchial stumps retained infected secretions to such an extent that they produced a distressing cough and a second operation was required.

STEPHEN B. TAGER, M.D.

**Planigraphy in the Diagnosis of Bronchogenic Carcinoma.** Leo G. Rigler and Thomas B. Merner. *Am. J. Roentgenol.* 58: 267-276, September 1947.

Planigraphy was done in a series of 47 cases of bronchogenic carcinoma. In only 5 instances was there failure to demonstrate the lesion. Bronchography was done in 19 of these cases and the lesion was demonstrated in all but one. Bronchoscopy was done in 33 cases and the lesion was demonstrated in all but 5 of this group.

The authors go into considerable detail regarding the technique employed. The importance of taking an adequate number of films at various levels is pointed out. Excellent illustrations demonstrate the various types of lesion and also emphasize the errors of technique and interpretation.

It is concluded that planigraphy compares favorably in accuracy with other roentgen methods while it is free of the complications and contraindications which affect other types of examination such as bronchography and bronchoscopy.

G. K. VOLLMAR, M.D.

**Anatomic Basis of Radiologic Images Called Atelectasis by Obstruction.** Anatomic Evolution of the Lesions. P. Galy and A. Duprez. *J. franç. méd. et chir. thoraciques* 1: 302-317, June 1947.

The development of atelectasis was followed in 11 cases in which pneumonectomy or lobectomy had been performed because of bronchial obstruction due to slowly growing polypoid tumors. The operations had been done from a few weeks to several years after the radiologic appearance of atelectasis.

The pathologic anatomy of atelectasis is as follows. On gross examination, the lobes are reduced in volume, slate gray in color and have the consistency of muscle. Gross section reveals general bronchial dilatation with peri-bronchovascular sclerosis. The pleura is generally thickened. Microscopically during the earliest stage of the process the alveoli are flattened and the septa are somewhat thickened. There is no visible exudate in the alveoli.

The next stage shows an increase in septal thickening, the appearance of peri-lobular and peri-bronchovascular sclerosis. Along these bands of sclerosis cuboid epithelium is seen lining certain alveoli. The respiratory bronchioles are thickened and flattened.

The process now progresses in one of two ways. On the one hand the cuboid cells lining the alveoli may persist and the septa increase in thickness. There is intense peri-bronchovascular sclerosis, the pulmonary parenchyma is said to be in a state of "atrophic involution." On the other hand there may be a round cell invasion of the alveolar spaces resulting in homogeneity of the

parenchyma with disappearance of the alveoli. In either case infection may occur. The findings are then extremely variable, since alveolitis, abscess formation, bronchial dilatation etc. may occur. Only the earliest stage of atelectasis limited to alveolar collapse, is reversible.

The anatomic changes described are not pathognomonic of atelectasis by obstruction. The same findings are seen in the parenchyma surrounding primary dilatation of the bronchi (without manifest stenosis), about areas of pulmonary sclerosis or old abscesses and in lungs under collapse by pleurisy, pneumothorax or thoracoplasty.

Total bronchial obstruction is not indispensable to the formation of the described pulmonary changes. The authors believe that the autonomic nervous system plays a role in the process.

RODERICK L. TONDREAU, M.D.

**Difficulties and Uncertainties of the Problem of Bullous Emphysema Due to Bronchial Obstruction.** P. Pruvost and Mennerat. *J. franç. de méd. et chir. thoraciques* 1: 289-301, June 1947.

The problem of the diagnosis of bronchial obstruction as the cause of bullous emphysema is discussed. Bronchial obstruction is not the only cause of bullous emphysema, since any factor which provokes diminution, loss of elasticity, or atrophy of pulmonary emphysema may lead to the development of bullae. Such bullae are often found in cases of generalized atrophic emphysema and in an atrophic type of pneumonia described by Bezançon and Delarue (*Ann. d'anat. path.* 13: 241, 1936). In order to make a diagnosis of bullous emphysema by bronchial obstruction, the following conditions must be fulfilled: (1) previous integrity of the parenchyma in the involved area, (2) successive appearance of emphysema and atelectasis, (3) discovery of bronchial obstruction in the corresponding segment.

RODERICK L. TONDREAU, M.D.

**Roentgen Diagnosis of "Pseudo-Abscesses" of the Lungs.** Robert Lenk. *Acta radiol.* 28: 405-413, Aug. 30, 1947. (In German.)

Most of the pseudo-cavities seen in roentgenograms of the chest are emphysema blebs. Only in rare cases are they due to some other cause. The mechanism is such that there is a sort of valve stenosis of a small or large bronchus caused either by swelling of the mucous membranes or by an obstructing accumulation of secretion and mucus. Walls of the alveoli are torn down by the pressure, thus giving rise to "cavities" surrounded by fibrous rings.

These pseudo-abscesses are seen chiefly in children, due largely to the lack of elastic tissue in the infantile lung. Difficulty in diagnosis arises when the lesions are seen in the course of an infectious lung process for they are easily mistaken for true abscesses.

Three well illustrated case reports are given of children between the ages of two and four with acute lung infections and roentgen evidence of abscess formations.

The author emphasizes the vital importance of an early and correct diagnosis because of its therapeutic significance. In pseudo-abscesses the general condition of the patient is relatively good; the cavity varies in size and soon disappears. No fetid odor is noted and no elastic material is found in the sputum. The cavity

is sharply defined and has a regular shape from its inception. The ring consists mainly of atelectatic lung tissue.

EUGENE F. LUTTERBECK, M.D.

**Pulmonary Embolism in Medical Patients: Comparison of Incidence, Diagnosis, and Effect in 273 Cases at the Massachusetts General Hospital in Two Five-Year Periods (1936 to 1940 and 1941 to 1945 Inclusive).** Jacques Carloti, Ira B. Hardy, Jr., Robert R. Linton, and Paul D. White. *J. A. M. A.* 134: 1447-1452, Aug. 23, 1947.

An analysis of 273 cases of pulmonary embolism in medical patients at the Massachusetts General Hospital was made in two five-year periods (1936-40 and 1940-45, inclusive). During the entire ten years the incidence in medical patients was more than twice that in surgical patients. The majority of the medical patients had some form of heart disease, many had associated cardiac failure and auricular fibrillation. Nevertheless, in only a few cases were mural thrombi in the right side of the heart found at autopsy. Thrombi, however, were present in the veins of the legs in over three-fourths of the cases in which the leg veins were examined.

Clinical and roentgenographic diagnoses of pulmonary emboli improved in the later period because of increased awareness of this complication. Hemoptysis was relatively infrequent, but tachycardia out of proportion to the degree of fever or dyspnea was a leading sign. An electrocardiographic pattern of acute cor pulmonale was present in a fair number of patients examined.

Mortality from pulmonary embolism dropped sharply to nearly one half in medical patients when routine interruption of the femoral veins was undertaken. Bilateral common femoral interruption is stated to be necessary to prevent recurrent emboli.

L. A. POZNAK, M.D.  
(University of Michigan)

**Roentgenologic Aspect of Pneumonias.** Joseph V. Hopkins, Jr., and Leon J. Menville. *New Orleans M. & S. J.* 100: 63-66, August 1947.

The authors question the practice of giving chemical or antibiotic therapy in suspected cases of pneumonia and ruling out that diagnosis in the absence of a favorable response, comparing such a procedure to the old quinine test for malaria. Pneumonitis with patchy lobar or lobular consolidation may be due to a wide variety of conditions, which may or may not respond to chemical and antibiotic drugs and which may give little evidence of their presence on physical examination. The roentgen ray, however, often clearly demonstrates the pathologic process, in some instances as early as eighteen to twenty-four hours after its inception and hours before any diagnostic physical signs are obtainable.

A list of conditions which are included under the designation pneumonia classified etiologically, follows:

#### Virus

1. Primary atypical pneumonia
2. Influenza (epidemic)

#### Rickettsia

1. "Q" fever
2. Psittacosis

**Bacteria**

- 1 Lobar pneumonia
- 2 Bronchopneumonia
- 3 Tuberculous pneumonia
- 4 Friedlander's bacillus pneumonia
- 5 Chronic interstitial pneumonia
- 6 Streptococcic pneumonia
- 7 Tularemia
- 8 Bubonic plague pneumonia
- 9 Glanders pneumonia

**Fungi**

1. Actinomycosis
- 2 Blastomycosis
- 3 Aspergillosis
- 4 Moniliasis
- 5 Histoplasmosis
- 6 Torulosis
- 7 Coccidioidomycosis

**Protozoan Parasite**

- 1 Toxoplasmosis

**Chemical**

- 1 Lipoid pneumonia
- 2 Irritating gas

**Circulatory**

- 1 Rheumatoid pneumonia
- 2 Hypostatic pneumonia

**Foreign Bodies**

- 1 Silicosis
- 2 Bagassosis

**Allergy (?)**

- 1 Löffler's syndrome

X ray examination of the chest is particularly useful in the following respects

- 1 To determine whether a suspected lesion is in the parenchyma of the lung, which information is important for an early diagnosis of pneumonia. Bacterial lobar pneumonia may be diagnosed within a very short time after the onset of symptoms, in other types of pneumonia roentgen evidence of the disease appears less rapidly

- 2 To aid in differentiating certain conditions which at times may be confused clinically with pneumonia

- 3 To localize and visualize the distribution of a pneumonic process

- 4 To determine whether the lesions show roentgen evidence of progression or regression

- 5 To follow the process of resolution and discover residual processes such as unresolved pneumonia, pleural changes and abscess formation

- 6 To determine whether the pneumonic process is complicated by abscess formation atelectasis and pleurisy with effusion

- 7 To locate pneumonic processes situated behind the heart or below the dome of the diaphragm which usually give but slight physical signs

A comparison of the authors' classification with that of Sante (J Missouri M A 43 93 1946 Abst in Radiology 48 94 1947) is of interest

SIDNEY F THOMAS, M D

all the criteria essential to the diagnosis of primary atypical pneumonia a respiratory disease of insidious onset, non bacterial in nature, sometimes more striking roentgenologic findings than anticipated, leukopenia, a normal white blood count or moderate leukocytosis, pulse and respirations low in relation to the temperature and failure of response to sulfonamides

From this study the author reaches the following conclusions (1) Virus pneumonia is a highly communicable disease (2) Its course may be anything but "benign" (3) The disproportion between physical findings and roentgen findings has been overemphasized. In only one case in this series were the x-ray findings greatly out of proportion to the physical findings (4) The ineffectiveness of sulfa therapy was repeatedly demonstrated and in one instance a near fatality followed persistence in its use

**Benign Pneumonia in West African Soldiers** A S Hollins Lancet 2 235-238 Aug 16, 1947

This paper is based on observations made on 172 West African soldiers suffering from pneumonia in a military hospital in Sierra Leone between August 1944 and April 1945. The term "pneumonia" is used in the broadest sense to include all cases of inflammation of the substance of the lung in which there was clinical or radiologic evidence of an alveolar exudate. The cases were primarily classified on purely clinical grounds into four main groups—classical, atypical, abortive, and bronchopneumonia. The various laboratory and radiological findings were afterward correlated with this clinical classification. The proportion of clinical types was: classical 69 per cent, atypical 11 per cent, abortive 9.5 per cent, bronchopneumonia 5 per cent, others 5.5 per cent. Of the 118 cases of the classical type, 62 presented a very benign clinical picture but none of these cases could be regarded as variants of primary atypical pneumonia.

There were signs of consolidation in the first twenty-four hours in 66 cases and late consolidation in 38, the remainder showed no evidence of consolidation at any time. In 57 cases pathogenic bacteria were found in the sputum, in 47 there was pus only, the remaining 66 either had no sputum (40) or saliva only (26). Roentgen examination revealed lobar involvement in 163 cases, one lobe only being involved in 89.5 per cent.

Complications were rare, crisis was early and resolution was rapid. The average stay in the hospital, including convalescence, was only fourteen days. One patient with hemolytic anemia, associated with well marked sickling of the red cells, died.

**Rheumatic Pneumonitis. A Case of Widespread Chronic (Proliferative) Type with Acute (Exudative) Foci** E E Murrhead and A E Haley Arch Int Med 80 328-342 September 1947

A case is reported which presents the concomitant occurrence of known healed and active rheumatic cardiac lesions and a peculiar interstitial and intra-alveolar pneumonitis. The pneumonitis was widespread, demonstrating a healed (proliferative) phase with extensive fibrosis and an active (exudative) phase. In addition, partly healed arterial lesions were observed within the lungs.

The repeated observation of rheumatic lesions in association with pneumonitis is considered significant and supports the term rheumatic pneumonitis.

**Virus Pneumonia** Guy R McCutchan Am J Med 3 323-334 September 1947

Sixty-one cases of virus pneumonia were studied by the author between 1942 and 1944. These patients had

**Tularemia Pneumonia (Opossum as Source of Infection)** J A Ossman and E R Bohrer J Missouri M A 44 659-661, September 1947

The occurrence of tularemia pneumonia is reported in 2 youths of sixteen and twenty, who had been companions on a rabbit hunt. Several rabbits were shot and without being skinned were fed to some opossums. Several of the latter animals became ill and died and were skinned by the boys without the protection of gloves. Subsequently both became ill with roentgen evidence of pneumonitis and pleural effusion. Agglutination tests for tularemia were positive. Both patients responded favorably to streptomycin.

**Significance of the Time Element in Tuberculous Infiltrations** H A Burns Dis of Chest 13 456-462, September-October 1947

Because of the increased life span, there is an increasing incidence of certain clinical conditions formerly considered rare as a known cause of illness or death. The importance of this changing period of longevity for the evaluation of pulmonary shadows is stressed.

The author's observations were made in various Minnesota institutions for the mentally ill and among members of the military forces hospitalized in Minnesota. Ninety-seven cases in the latter group in which induction films were available are analyzed from the point of view of later breakdown. With negative films on induction 1 broke down in less than one month, 1 in less than three months, 6 in less than six months, 13 in less than one year, and 25 after one year. Fifty-one cases showed parenchymal infiltrates on the induction films, and of these 31 broke down in less than one year, and 20 after one year.

These figures would indicate the importance of the repetition of x-ray surveys for case finding in special groups. Tuberculosis however is largely limited to the family and the relatively small community group, where dependence upon survey would permit many cases to progress to an advanced state while waiting for a routine survey. Early infiltrations becoming established over a period of weeks or at most a few months emphasize the fact that the diagnosis of tuberculosis cannot be separated from medical practice. Maintenance of the patient-doctor relationship can help in the effective execution of any contagious disease control program, while routinizing the control technic may defeat the very object for which it was created.

Dr J A Myers in his discussion of the paper commented that he had observed moderately and far advanced lesions develop in a short interval of time in tuberculin reactors. He was ready to recommend that adult tuberculin reactors have roentgen examinations of the chest at least every six months and regarded any program which provides for x-ray inspection of chests of adult tuberculin reactors only once in two, three, or five years as inadequate. HENRY K TAYLOR, M D

**Tuberculous Pleurisy with Effusion. An Analysis of 215 Cases Hospitalized at an Army Chest Center** Irwin G Karron and Robert K Purves Am Rev Tuberc 56 184-189 September 1947

An analysis is given of 215 cases of tuberculous pleurisy with effusion studied at one of the Army tuberculosis centers. Induction roentgenograms were available in 88 of these patients and 4 (5.0 per cent) of these showed evidence of probably active disease at the time

of induction. In 89 (42.0 per cent) of the patients, parenchymal disease was present, with a somewhat higher incidence among the non-white group. In 16 of the patients fluid was present on both sides. During the period of observation, which varied from six to twelve months, dissemination of the parenchymal disease occurred in 34 (16.0 per cent) of the patients. Of the predominant symptoms pain and fever were outstanding. Cough, fatigue, dyspnea, and weight loss were relatively common. Hemoptysis occurred in only 7 per cent. In 7 of the cases pleurisy was discovered by routine x-ray examination following admission for other complaints, showing that the onset may occasionally be insidious. L W PAUL, M D

**Spontaneous Healing of Localized Hematogenous Spread in Pulmonary Tuberculosis** Lasar Dunner Am J Roentgenol 58 283-290 September 1947

The main purpose of this paper is to draw attention to the spontaneous healing of a uniform extensive or localized tuberculous spread in the lung. The spread is thought to be hematogenous and to have been established in the interstitial tissue without communication with the air passages. No rales, even post-tussic, are found. The author believes the absence of rales is important in differentiating between interstitial and bronchogenic infection and is therefore a significant prognostic sign.

Roentgen examination in these cases shows an evenly distributed, closely packed spread, mainly of small foci which seemed to have developed simultaneously. There is no evidence of an 'old' lesion and no evidence of cavitation. Several sets of roentgenograms are reproduced illustrating the initial lesions and healing of the lesions after various periods.

The author proposes the name of chronic localized miliary tuberculosis of the lungs for these cases.

**Importance of Bronchial Rupture in Tuberculosis of Endothoracic Lymph Nodes** O Görgényi-Göttche and D Kassay Am J Dis Child 74 166-206, August, 1947

Tuberculosis of the endothoracic lymph nodes in children is always of importance because of the possible complications. Extrinsic pressure upon the bronchi may produce atelectasis, which may be followed by bronchiectasis. The caseation in the lymph node may extend to the bronchial wall causing granulation tissue to appear in the lumen of the bronchus. As the process continues, the bronchial wall may be destroyed and the caseous contents of the nodes are evacuated into the lumen of the bronchus. Lodged in the bronchus they may cause obstructive emphysema or atelectasis. If the caseous material is coherent and elastic the masses may be quite large, and sudden death from obstruction of the trachea or larynx may ensue. If the caseous material crumbles it may be coughed out or aspirated. If the caseation has produced pus, severe bronchial spread of the tuberculosis may result. The authors concern themselves with the importance of bronchial rupture feeling that this eventuality has not been sufficiently emphasized or recognized.

The classical roentgen signs of atelectasis include diminution in size of part of the lung, increased density usually with a sharp border, compensatory emphysema of the rest of the lung, and movement of the mediastinal organs to the affected side during deep inspiration.

(Holzknecht-Jakobson sign) Bronchoscopy was done in 28 cases showing atelectasis. In 18, caseous tuberculous material or granulation tissue was found. Removal of caseous debris usually caused the atelectasis to disappear. In 3 cases, lymph node encroachment upon a bronchus was seen. In the remaining 7 cases, bronchoscopy revealed no abnormality.

It is of importance to recognize that atelectasis is due, in a surprisingly high percentage of cases, to rupture of a caseous node into a bronchus. The authors feel that bronchoscopy is then indicated. If the caseous matter can be removed, the improvement is dramatic, provided the tuberculosis does not become hematogenous.

PAUL W. ROMAN, M.D.

**A Suggested Tuberculosis Control Program for the Penal Institutions of Ohio.** John V. Horst and Oren A. Beatty. *Ohio State M. J.* 43: 825-828, August 1947.

It is well known that tuberculosis occurs frequently and spreads easily in the crowded quarters prevailing in most penal institutions. The authors surveyed the methods used for the control of the disease at various penal institutions in the state of Ohio and in most cases found them quite inadequate. Routine chest x-ray examinations over a period of two years on all persons committed to the State Reformatory showed the incidence of tuberculosis to be 3.67 per cent—2.14 per cent active lesions and 1.52 per cent healed lesions. The percentages were slightly lower for white and slightly higher for colored persons. The number of active and healed cases were about the same in white admissions but the number of active cases was almost three times that of the healed cases in colored admissions.

The authors recommend: (1) a central classification center where every individual admitted may have a thorough examination, to include an x-ray study of the chest by the large film method and search for extrapulmonary tuberculosis, (2) mass x-ray surveys by the small film method of all inmates at yearly intervals, (3) a similar survey of the personnel of the institutions, (4) erection of a penal sanatorium for isolation, treatment, and rehabilitation of all inmates found to have tuberculosis.

B. S. KALAJIAN, M.D.

**Routine Chest Roentgenograms in Pregnancy.** A Supplementary Study. Hervey K. Graham. *West J. Surg.* 55: 438-441, August 1947.

In 1941 the author reported the roentgenological chest findings in 800 consecutive obstetrical cases (*West J. Surg.* 49: 107, 1941; *Abst. in Radiology* 37: 246, 1941). Eight of the 800 patients (1 per cent) had active tuberculosis and 24 (3 per cent) had clinically significant lesions. Since that time an additional 1,267 patients have been examined. In this series there were 8 cases of active tuberculosis (0.6 per cent) making a total of 16 active cases in the combined series (0.77 per cent). Two patients in the second series were treated by therapeutic abortion and the other 6 by clinical supervision and rest routine. Two of the patients who were treated by therapeutic abortion in the first series and whose disease became arrested under adequate management later progressed uneventfully through pregnancy and delivery.

Clinically important lesions were found in 57 cases (3.6 per cent). These, with 24 cases in the first series, make a total of 71 cases (3.44 per cent). Evidence of

old pleurisy was present in 105 patients (8.3 per cent). These with 49 of the previous series make a total of 154 cases (7.45 per cent). Evidence of repeated respiratory infection and bronchial allergy appeared in 131 patients (10.3 per cent) which, with the 73 of the earlier series, make a total of 204 (9.87 per cent).

The number of patients with calcifications and, occasionally, slight fibrosis—usually considered the contact type of case—was increased in the second series. There were 573 such cases (45 per cent) in this group as against 205 (24 per cent) in the first. The phthisiologists felt that more detailed reporting of the films might account for this difference.

**Mass Radiography in Glasgow.** Report on First 50,000 Examinations. Alex. Maclean. *Edinburgh M. J.* 54: 488-495, September 1947.

During a mass chest survey in Glasgow (Scotland) covering a period of almost two years, 50,000 examinations were made. The group consisted of 25,525 males and 24,475 females. Sixty per cent of the examinees were under twenty years of age, with a preponderance of females under thirty and a preponderance of males over that age.

If known pulmonary tuberculosis, which occurred once in about 700 examinations, and obviously calcified lung and root node lesions, which were observed once in every 30 examinations, are discounted, the incidence of active tuberculosis in the entire series was 345 (6.9 per 1,000) and of inactive tuberculosis 827 (16.5 per 1,000).

The ratio of inactive to active disease in the various age groups suggests that, if tuberculosis is found in the fifteen to nineteen-year group, there is a half-and-half chance that it is active.

Of 146 patients aged nineteen or younger, 106 had unilateral disease, whereas of 58 patients aged twenty years and over, 34 had unilateral disease. It would appear, therefore, that even with mass radiography of the supposedly healthy population, pulmonary tuberculosis is not detected early enough.

**Mass Radiography Service in Dublin.** M. G. Magan. *Irish J. M. Sc.* pp. 580-586, September 1947.

The Dublin Corporation X-Ray Centre got under way in June 1946 and by the end of the following February miniature films had been taken on 7,187 persons (6,094 adults, 1,093 juveniles). Among the adults there were 74 cases of active pulmonary tuberculosis of which 17 were diagnosed on a former occasion at a tuberculosis dispensary or hospital, 14 were referred for a ray by the patient's own doctor, and 43 were not previously diagnosed. On this basis it is figured that in Dublin, to date there are approximately 7 cases of active pulmonary tuberculosis previously undiagnosed per 1,000 examined. This figure might be taken as indicating the presence of some 3,500 cases of undiagnosed pulmonary tuberculosis in the population of the city.

**Sarcoidosis.** A Clinical and Roentgenologic Study of Twenty-eight Proved Cases. James J. McCort, Richard Hugh Wood, John B. Hamilton, and David E. Ehrlich. *Arch. Int. Med.* 80: 293-321, September 1947.

Twenty-eight cases of proved sarcoidosis were seen at an Army general hospital between July 1, 1942 and April 1, 1946. Twenty-seven of the patients were men, 15 were Negroes. The great majority were in the third and fourth decades. The youngest patient was a

girl thirteen years of age, and the oldest was a man of fifty-eight

Six persons had no symptoms their disease having been discovered only by routine roentgen study of the chest. Cough and dyspnea were the most frequent symptoms, probably due to the fact that all patients had intrathoracic disease. The peripheral lymph nodes were found to be enlarged in 26 of the series. Involvement of the eye was observed in 11. The tuberculin skin test was done in 25 cases, the reaction was negative in 21, doubtful in 2, and weakly positive in another 2.

In all 28 patients there was roentgen evidence of intrathoracic lymphadenopathy. Its presence is not easily detectable. Examination should include careful fluoroscopy, with a swallow of barium during the course of the study. A postero-anterior and lateral examination should be made, together with such oblique views as are deemed necessary. A Bucky-Potter diaphragm will aid in the delineation of the trachea and the major bronchi, and a laminagram may be of value in selected cases. With this careful technic, nodes of 2 cm in diameter or greater will be detected. Nodes smaller than this are not likely to be seen even with the best technic now available because of the density of the overlying structures.

The roentgen study of the 28 cases revealed the following features: (a) enlargement of the paratracheal lymph nodes in all, (b) enlargement of the peribronchial lymph nodes in 25, (c) pulmonary parenchymal involvement in 15, (d) pleural effusion in 2 instances, (e) pericardial effusion in 1 instance and (f) osseous changes in the hands of 6 patients. In 11 of the 28 cases the enlargement of the intrathoracic lymph nodes was more prominent on the right side which may be explained on the basis of the greater number of lymph nodes normally present on that side. In 27 of the 28 cases the enlarged intrathoracic lymph nodes tended to remain discrete and well defined. Calcification within the lymph nodes was seen in only 1 instance. In the course of the disease the enlarged lymph nodes may undergo spontaneous regression, to be replaced by fibrous tissue, this may be accompanied by increased evidence of parenchymal pulmonary involvement.

Roentgen therapy was of no value in the treatment of the enlarged lymphoid nodes of sarcoidosis in the 2 cases in which a test dose was tried (1 300 r at 220 kv, 15 ma, 50 cm distance, and half-value layer 1.34 mm copper).

Six case histories are included.

**Roentgenologic Manifestations of Coccidioidomycosis** C Allen Good Proc Staff Meet, Mayo Clin 22 341-345 Aug 20, 1947

In a brief but conclusive article Good mentions the various types of pulmonary manifestations of coccidioidomycosis. He also refers briefly to the disseminated form of the disease with reference to the major sites of bone involvement. In his final paragraph he calls attention to the fact that the disease may be encountered in areas that are not endemic and that the history must be carefully investigated for possible exposure. He calls particular attention to the persistence of cavities and nodular foci for a long time after the original acute pulmonary onset. He states that 10 per cent of the acute pulmonary lesions may persist, leaving nodular parenchymal foci, cavities, persistent pneumonitis, hilar adenopathy, mediastinal adenopathy and occasionally persistent pleural effusion.

The abstractor has seen nodular lesions present two years after the original onset. He has also observed one case of cavitation one year after onset, in which the sputum was positive for both tubercle bacilli and the organism of coccidioidomycosis. This is a very timely article and the disease should be kept in mind particularly in examination of ex-service men who have had desert training. ROBERT C PENDERGRASS M D

**Coccidioidomycosis in Phoenix, Arizona** Howell Randolph and H L McMartin Dis of Chest 13 471-478, September-October 1947

In a survey of the public schools of Phoenix, Ariz. including junior college, the Arizona Vocational School, and high schools for white and colored students 1,348 pupils were tested with coccidioidin. Of this number 798 (59.2 per cent) gave a positive reaction and 63 (4.7 per cent) a doubtful reaction, 487 (36.1 per cent) were negative. In few of the cases was there any clinical evidence of the disease. From these observations, it appears that infection must usually take place in childhood and that in a great majority of cases it is transitory and mild.

It is pointed out that in the Phoenix area the possibility of coccidioidomycosis must be kept in mind in interpreting chest films. A series of 11 cases of clinical infection is presented in tabular form. In these the roentgen findings included small thin-walled cavities, multiple calcifications, small nodular lesions, peribronchial thickening, enlarged hilar shadows, and diffuse cloudy shadows. Mantoux tests were negative in 8 of the cases, and in 2 no report was made. The coccidioidin test (1:1,000) was positive in all.

Considering the high number of sensitized individuals the incidence of infection is extremely low. While the disease is usually mild and self-limited, serious cases do occur. One example is presented in which a diagnosis of carcinoma of the lung was made and a lobectomy was performed. Death occurred on the third postoperative day. Coccidioidal granuloma was proved microscopically. HENRY K TAYLOR M D

**Amebiasis with Pulmonary Involvement** Felix A Hughes Jr and Kean F Westphal Arch Surg 55 304-315 September 1947

Three cases of pulmonary involvement as a complication of amebiasis are reported as a basis for discussion. The clinical symptoms at the beginning are usually those of acute amebic hepatitis. Roentgen study at this time shows elevation, irregularity and fixation of the right leaf of the diaphragm. Pleural involvement leads to cough, pain in the chest aggravated by deep breathing, and finally to pleural effusion. The x-ray findings at this stage are generally interpreted as resulting from pneumonia. The pleural aspirate is a sterile bloody or reddish-brown material.

When the lung becomes involved, bloody purulent material which may contain amebae is expectorated. The chest film usually shows a fixed, elevated diaphragm with localized bulging and obliteration of the cardiophrenic and anterior costophrenic sulci, and a characteristic triangular shadow with its base toward the liver and its apex toward the hilum. Cavitation may be present. After rupture into a bronchus, the bronchohepatic fistula may be demonstrable by injection of iodized oil.

The most important factor in making the diagnosis is

to consider the possibility of this condition. A presumptive diagnosis may be made in the presence of an enlarged, tender liver, a fixed elevated right diaphragm and characteristic roentgenologic changes. A positive diagnosis is made by a characteristic response, to emetine, or by finding amebae in the sputum or aspirated fluid. Treatment should combine emetine hydrochloride with either chunofoin or diodoquin. The high mortality following surgical drainage ordinarily contraindicates this procedure, especially as medical management usually leads to recovery, with minimal pleural scarring. LEWIS G. JACOBS, M.D.

**Pulmonary Vascular Lesions in Silicosis and Related Pathologic Changes.** Erving F. Geever. *Am J M Sc* 214: 292-304, September 1947.

The effect of silicosis on the pulmonary circulatory system, and indirectly on the right half of the heart, constitutes one of the important complications of this disease.

The pulmonary vascular lesions and related pathologic changes were studied in cases of silicosis and a comparison was made with non-silicotic patients in the same age group. Patients with tuberculosis were excluded.

Two processes appeared to be responsible for the pathologic changes: direct encroachment on the vascular wall by nodules or nodular masses and infiltration of the vascular wall by dust- and pigment-bearing granulation tissue. In massive conglomerate nodular silicosis, the vascular lesions were severe and were found in all vessels of all sizes. In discrete nodular silicosis the vascular lesions were found only in the smaller vessels and were not striking. The veins showed changes similar to the arteries but appeared to offer less resistance to fibrous encroachment. The lymphatic vessels also showed stasis and distention.

In most of the patients there was pathologic evidence of right ventricular hypertrophy. Marked fibrosis and in cases with conglomerate masses, ischemic necrosis occurred. The ischemic necrotic cavities occurred in the centers of fibrous masses while pseudo cavities in emphysema occurred at the margins.

Intravascular pressure changes are believed to be important factors in the pathogenesis of vascular lesions. Since normal pulsations may be significant in producing vascular injury to vessels fixed at various points by fibrous masses, the pulsations in increased intravascular pressure should be even more significant.

BENJAMIN COPELAND, M.D.

**Benign Pneumoconiosis Due to Metal Fumes and Dusts.** O. A. Sander. *Am J Roentgenol* 58: 277-281, September 1947.

Benign pneumoconioses are those resulting from inert dust deposits in the lungs which are not the cause of any fibrosis or disability. Siderosis is of this type. Postmortem examinations show deposits of radiopaque iron particles in the lymphatic channels and nodes surrounding the blood vessels and bronchi. The cases studied by the authors showed no evidence of fibrosis. They emphasize that special stains are necessary to show the iron deposits and also point out that gross fibrotic appearing lesions should not be diagnosed as fibrosis without connective tissue stains.

Three cases of siderosis developing in men employed in metal cutting with the oxy-acetylene flame are re-

ported. All of these showed gradual development of discrete nodulation or stippling throughout both lung fields, with no tendency to confluence of the shadows. Hilum shadows were smaller than would be expected with silicosis of this degree. None showed clinical symptoms or findings such as would be seen with silicosis of this degree. G. K. VOLLMAR, M.D.

**Chlorine Accident in Brooklyn.** Herbert Chasis, John A. Zapp, James H. Bannon, James L. Whittenberger, John Helm, James J. Doheny and Colin M. MacLeod. *Occup Med* 4: 152-176, August 1947.

On June 1, 1944, in Brooklyn, N.Y., a tank containing approximately 100 pounds of chlorine being transported by truck, began to leak, emitting the liquid gas from a one-eighth-inch orifice for seventeen minutes. The concentration of chlorine in the street and in the immediate vicinity was high enough to drive people indoors for a few minutes but only 2 casualties with a history of such exposure are recorded. The truck was about 30 feet from a subway station entrance and about 18 inches from a series of gratings covering ventilation shafts leading from the sidewalk to the subway station platform. The direction of the wind was such as to carry the cloud over the ventilation shafts. This, with the tendency of the dense gas to settle to low levels and the piston action of the subway trains in pulling the gas into the station, built up a high concentration of chlorine in the subway station. Four hundred and eighteen persons thus exposed were examined in eight hospitals and 208 were admitted for treatment. Of the 133 persons admitted to Cumberland Hospital, 33 were hospitalized for one to two weeks and serve as the basis of the present report.

Symptoms during the first few hours after exposure consisted of burning of the eyes with lachrimation, burning of the nose and mouth with rhinorrhea and increased salivation, cough, choking sensation, and substernal pain. These were frequently accompanied by nausea, vomiting, headache and dizziness. Except for cough, substernal pain, and respiratory distress, immediate symptoms subsided within twenty-four hours.

Tracheobronchitis was evident in all 33 patients within twenty-four to forty-eight hours, subsiding in most instances in five to seven days. Pulmonary edema, chiefly basilar in location, was observed in 23 out of 30 patients. In 14 pneumonia developed, in 13 the pneumonitis was basilar and in the fourteenth it was hilar. Except in 3 patients, the clinical course of the pneumonia was relatively benign.

The abnormal pulmonary features noted in the roentgenograms consisted of mottling, patches of irregular density and differences in the degree of aeration of both pulmonary fields. The mottling observed in early films was interpreted as pneumonia and the difference in aeration in both pulmonary fields as obstructive emphysema. In the majority of patients the roentgen changes were not remarkable and a single roentgenogram could easily have been interpreted as normal. It was only by comparing serial films taken during the first two week period that the lesions became evident. The roentgenograms showed that pulmonary edema and the pneumonia that followed were predominantly basilar. In one patient, however, who did not have any evidence of pulmonary edema, the pneumonia that developed toward the end of the first week was hilar.

There were 3 instances of unequal aeration in both

pulmonary fields which were interpreted as being consistent with the diagnosis of obstructive emphysema. The difference apparently was transient, since films taken earlier and later did not show the phenomenon. At the time of discharge all roentgenographic abnormalities attributed to the chlorine either had cleared or were clearing.

Oxygen at atmospheric pressure was administered to all acutely ill patients for periods up to ninety-six hours. Oxygen under positive pressure was administered to 20 patients as soon as facilities were available, and this therapeutic measure was continued intermittently for varying periods, in one instance for forty eight hours.

The incidence of pneumonia in 22 patients who received sulfadiazine or penicillin from the first day following exposure was 32 per cent, while in 11 patients who did not receive chemotherapy it was 64 per cent.

Eleven of the 33 patients who were observed for sixteen months after discharge from the hospital had no symptoms attributable to exposure to chlorine. Sixteen patients had anxiety reactions with phobias, hysterical phenomena and psychomotor dysfunction persisting for one to sixteen months. There was no evidence that chlorine intoxication produced pulmonary disease in any of the patients.

#### Miliary Appearances in the Lungs in Mitral Stenosis. Endogenous Pulmonary Hemosiderosis. T E Gumpert. Brit M J 2 488-489 Sept 27 1947

Aggregations of so-called heart-failure cells in the alveolar spaces and interstitial tissues of the lungs have been known to pathologists and physicians for many years but their recognition by means of radiographs in certain cases of mitral stenosis is a relatively new achievement and correspondingly little known. The author reports a case and discusses the factors which may have been responsible for radiological appearances closely resembling miliary tuberculosis.

The patient was a 36 year old man admitted with a diagnosis of mitral disease, a small aortic leak and auricular fibrillation. A radiograph of the chest revealed typical mitral configuration of the heart with a prominent pulmonary artery shadow, a small aortic knuckle, a well rounded and enlarged right auricular shadow and a hypertrophied left ventricle with a straightish left border. Both lung fields were uniformly stippled from apex to base, the appearance closely resembling the punctate mottling of miliary tuberculosis or a finely disseminated pneumoconiosis. The pulmonary artery shadows were prominent but there was no gross evidence of pulmonary congestion. A roentgenogram taken ten years before showed a typical mitral heart with increased vascular shadows but no nodulation.

The mechanism responsible for the pulmonary picture would appear to be as follows: the mitral obstruction causes an increase of pressure in the left auricle and its ultimate tributaries the alveolar capillaries. With such engorgement there may be repeated intra-alveolar hemorrhages. The hemoglobin disintegrates and is converted into relatively soluble particles of iron-containing hematin and relatively insoluble particles of iron-containing hemosiderin. The latter act as foreign bodies and are treated as such by the phagocytic histiocytes which engulf them. Their transport, however, by way of the lymphatic local lymphoid tissue is probably not so readily achieved as in true pneumo-

coniosis because of the chronic pulmonary congestion, with the result that most of the phagocytic hemosiderin-laden heart-failure cells remain in the alveoli and give the characteristic radiological alveolar stippling.

In conclusion, miliary appearances in the lungs in mitral stenosis occur from time to time and are considered due to an endogenous pulmonary hemosiderosis. It might be objected that mitral disease with chronic pulmonary venous congestion is so common in medical practice that the radiological appearances under discussion would be widely known, but this is not so. Conditions must obviously be peculiarly favorable to permit this orderly deposition of pigment throughout the lung substance and it is only by further observation and investigation that one is likely to discover the precise set of circumstances leading to a diffuse punctate pulmonary hemosiderosis in mitral disease.

EDSEL S REED M D

#### Intrathoracic Gastric Cysts. Edgar W Davis and David Salkin. J A M A 135 218-221 Sept 27 1947

One more case of intrathoracic cyst of gastro enteric origin is reported in the literature, the twenty-sixth to be recorded (to 1946). The greatest number of these congenital abnormalities have been reported since 1940 and this probably reflects the increasing use of roentgenography and exploratory thoracotomy.

The author's patient, a fourteen-year-old girl complained of pain in the right chest of many years' duration. Roentgenograms showed a large smoothly marginated homogeneous mass in the upper half of the right hemithorax for the most part posterior. This right-sided and posterior location has been characteristic of most of the cases reported in the literature. In this instance there was mild erosion of several adjacent ribs and also spina bifida occulta of two vertebrae the last cervical and first dorsal. Associated defects of this nature have also been previously reported.

The literature on the subject is reviewed. In addition to an intrathoracic mass there may be atelectasis, pleural effusion or pneumonitis. The cyst may rupture into a bronchus. Positive identification is usually made only at operation. Treatment is excision in one stage if possible.

L A POZNAK M D  
(University of Michigan)

#### Circulatory Effects of Three Modifications of the Valsalva Experiment. An Experimental Survey. Robert F Rushmer. Am Heart J 34 399-418, September 1947

Forced expiratory effort against a closed glottis is known as the Valsalva maneuver and the circulatory manifestations thus produced are reduction in the heart size, stroke volume, cardiac output, capillary flow, and venous return to the heart and an increase in the heart rate, venous pressure, and cerebrospinal fluid pressure. For a brief period after discontinuing the maneuver, as the distended veins become cleared of the accumulated blood, the heart size, stroke volume, cardiac output, and capillary flow are all greater than normal. With the increased stroke volume there is usually a bradycardia.

Because the cardiovascular system is subjected to strain during the Valsalva maneuver, the author hoped, by using it to be able to establish a testing procedure whereby he could distinguish adequate and inadequate

circulatory responses to the effects of gravitational forces in applicants for pilot training, and to gain information which might aid in an understanding of the mechanisms by which the cardiovascular system responds to stress. He modified the Valsalva maneuver in three ways. In the first he increased the intrapulmonic pressure 40 mm of Hg after a deep inspiration, so that the lungs were well inflated during the strain. This was accomplished by having the subject blow into a tube connected to a water manometer and sustain a column of water 54 cm high. The second maneuver was similar to the first except that most of the supplemental air was exhaled prior to the beginning of the strain. The third involved exhaling most of the supplemental air and then forcing air through a fixed leak in the manometer system, in lieu of the partially closed glottis, meantime vigorously tensing the voluntary musculature.

Teleroentgenograms were made before and after the first two modifications in order to determine changes in heart size and the position of the diaphragm. During the first maneuver the diaphragm was elevated in about half of the cases, and the cardiac silhouette decreased on an average of 20 sq cm or 17.1 per cent. During the second maneuver, the diaphragm moved up and the cardiac silhouette decreased on an average of 14.7 sq cm, or 10.4 per cent. During the third maneuver fluoroscopic observations revealed a continuing elevation of the diaphragm so long as air was being expelled. No measurements of cardiac area were attempted.

Simultaneous recordings of intrapulmonic and intragastric pressures were made during the three maneuvers, and the intragastric pressures were found to be higher. Arterial and venous pressures were also recorded, and volume changes in an index finger were determined by means of a pneumatic plethysmograph. An analysis of the author's findings shows that a greater stress on the circulation is obtained with the first modification of the Valsalva maneuver. The second and third maneuvers provide a favorable gradient in pressure between the abdomen and thorax thereby facilitating venous return from the splanchnic area.

The arterial blood pressure is a good indicator of the response of the individual. Accurate determinations cannot be made, however, with the ordinary sphygmomanometer. The apparatus required is bulky, difficult to maintain, and its use unpleasant for the subject.

Changes in finger volume were of less value than had been anticipated for there was difficulty in standardization, and no simple and accurate measure of the volume changes.

The rate of increase of venous pressure in the upper extremity resulting from a sudden increase in intrathoracic pressure after a deep inspiration may have some value as a measure of the state of the peripheral blood vessels below the point of measurement, but further study of the reliability and validity of this test is required.

HENRI K. TAYLOR, M.D.

**The Blalock Operation for Congenital Pulmonary Stenosis.** H. Brodie Stephens. *California Med* 67: 160-165, September 1947.

Diagnostic criteria which are considered essential for establishing an insufficient pulmonary blood flow as an indication for the shunt or by-pass operation originally performed by Blalock and Taussig are roentgen evi-

dence of a small pulmonary artery and clinical and roentgen evidence of absence of pulmonary congestion plus a heart of normal or small size. In 28 cases seen in the University of California Hospital in which it was believed that the operation offered a reasonable chance of benefit, preliminary angiocardigrams were obtained with the aid of diodrast. While these are not unequivocal, they furnish valuable information particularly as concerns the degree of cross chamber mixing and overriding of the aorta. Electrocardiograms characteristically show right ventricular hypertrophy in a very high percentage of cases with pulmonic stenosis. The shunt operation was done in 22 cases, with a single postoperative death.

MAURICE D. SACHS, M.D.

**Demonstration of the Motion of the Mitral Valve in Chest Roentgenograms.** O. Hubacher. *Acta radiol* 28: 386-389, Aug. 30, 1947. (In German.)

The author studied the movements of the mitral valve with an apparatus designed by the late Professor Adolf Licchti, which permits taking roentgenograms in 0.04 second, at any phase of the electrocardiogram. The patient was a woman, 71 years old, with a blood pressure of 170/95. Loud systolic murmurs were heard over all the heart valves. The roentgenogram of the chest revealed marked enlargement of the heart with aortic configuration and aortic sclerosis, and calcifications in the mitral valve region, apparently due to sclerosis.

Five roentgenograms were taken at five different points of the EKG, and the position of the valves was studied by superposition of the various projections. The first roentgenogram was taken at the height of the P wave, the second between S and T, the third at the end of T, closely followed by a fourth and fifth at the decline of the T wave.

According to Hubacher, the mitral valve showed linear movements. During systole it moved downward toward the apex, during diastole the movement was in the opposite direction, from the left lower apex region upward to the right upper side of the chest and base of the heart.

EUGENE F. LUTTERBECK, M.D.

**Massive Hydropericardium with Compression and Angulation of the Inferior Vena Cava.** Harry Greisman, Chester R. Brown, and Hans Smetana. *Am Heart J* 34: 447-455, September 1947.

The case history and postmortem findings are given for a 26-year-old colored female who had multiple hospital admissions during a two year period because of symptoms associated with a hydropericardium. Secondary changes, because of pressure, resulted in ascites and edema. During one of the hospital admissions the pericardium was tapped, 2,400 cc of a greenish yellow fluid was removed, and 1,760 cc of air injected. An x-ray examination before the pericardial tap showed the cardiac silhouette to extend from chest wall to chest wall. The distended cardiac silhouette simulated elevation of the diaphragm. X-ray examination following the injection of air showed the hydropneumopericardium with the pericardium extending to the axillary portion of the chest wall.

Massive pericardial effusions occur most frequently in rheumatic heart disease and tuberculosis of the pericardium. In this instance the etiology is unknown. Postmortem examination revealed compression and angulation of the inferior vena cava.

The author discusses the results associated with the central and peripheral types of pericardial effusion. In the central type the heart is primarily compressed, particularly the right auricle. The resulting circulatory congestive failure is uniform and generalized. In the peripheral type, the vena cava and hepatic veins may be compressed. The visceral congestion is localized and the congestive failure depends upon the pressure exerted on the radicals of the compressed veins.

HENRY K. TAYLOR, M.D.

**Rapid Development of Aneurysm of the Aorta.** I. J. Grek. *South African M J* 21: 638-639, Sept 13 1947.

A case showing the extreme rapidity with which an aneurysm of the aorta can develop and progress to a fatal termination is presented. Two chest roentgenograms are reproduced, one shows the apparently normal cardiovascular shadow and the other, taken only seven weeks later, the fully developed aneurysm.

## THE DIGESTIVE SYSTEM

**Congenital Atresia and Tracheoesophageal Fistula. Four Consecutive Cases of Successful Primary Esophageal Anastomosis.** William P. Longmire, Jr. *Arch Surg* 55: 330-338, September 1947.

The most common congenital anomaly of the esophagus is complete atresia, the upper segment ends in a blind pouch and the lower communicates with the trachea near the bifurcation. The accepted treatment for such patients is exploration with anastomosis of the esophagus if possible. If anastomosis is impossible, the two segments are exteriorized and a gastrostomy performed, with later union of the external fistulae by an anterior thoracic channel. Five patients were operated upon by the author with primary anastomosis, the first died postoperatively, while the remaining 4 survived with satisfactory function.

In diagnosis, the passage of a catheter into the oral pouch unless it is done under the fluoroscope may be misleading since the catheter may curl back and thus give the impression that it has passed into the stomach. The length of the upper esophageal pouch can best be determined by fluoroscopic observation of the segment filled with iodized poppyseed oil (40 per cent) or diodrast. Since the length varies with crying and with swallowing a single film may give a false impression. Over filling of the oral segment may also be misleading as the oil may be aspirated into the lower portion of the trachea and subsequent roentgenograms will show it below the level of the blind pouch, suggesting a stricture rather than a true atresia. The opaque material should be removed from the pouch at the close of the examination.

A full discussion of the operative technique is included. The complications observed were external fistula and stricture, but these were readily controlled by appropriate measures.

LEWIS G. JACOBS, M.D.

**A Procedure Helping the X-Ray Examination of the Gastro-Esophageal Segment.** Valmore Latraverse. *Am J Digest Dis* 14: 298-302, September 1947.

Visualization of the diaphragmatic portion of the esophagus is sometimes a difficult procedure. The authors have introduced a Levine tube into one naris and as the patient swallows have gradually forced the tube into the stomach. A 50-c.c. syringe is then

attached to the tube and air is injected under fluoroscopic control. Barium is also injected by this method. The value of the procedure is shown by description of its use in two cases.

The first patient was a male, aged 66, complaining of dysphagia and "heart trouble." At x-ray examination he was thought to have a cardiospasm associated with an epiphrenic left diverticulum of the lower end of the esophagus. The author succeeded in placing the tip of the Levine tube just above the cardia and filling the diverticulum with barium.

The second patient was a man of 35, complaining of pain in the epigastrium. By injection of barium through a Levine tube, it was possible to delineate the lower esophagus and to visualize the gastric mucosa above the diaphragm. A positive diagnosis of short esophagus and herniation of the stomach was made.

JOSEPH T. DANZER, M.D.

**Peptic Ulcer. A Diagnostic and Therapeutic Problem.** Sara M. Jordan. *Gastroenterology* 9: 237-248, September 1947.

In this paper, which was presented as an annual memorial lecture, the etiology, diagnosis and treatment of peptic ulcer are considered. The author states that the diagnosis is made too infrequently rather than too frequently and points out that many small ulcers are found at autopsy that were not previously diagnosed.

X-ray examination and endoscopy especially when the latter supplements the former, are the best aids in the diagnosis of esophageal and gastric ulcers, and x-ray alone in the diagnosis of duodenal and jejunal ulcers. The examination should always include fluoroscopy. This is especially true when there is a question of supplanting medical with surgical treatment or when the course of healing or the question of recurrent activity is being determined. Irritability in the still active or recurrent duodenal or jejunal ulcer is indicated by rapid filling and emptying of the bulb or by marked spasm in the duodenal bulb or at the stoma. Pin point tenderness elicited by the palpating hand, under fluoroscopic examination is always suggestive of severe activity and usually of penetration.

The esophageal ulcer is diagnosed by fluoroscopic and film examination of the esophagus and the observation of a break in the continuity of outline in the distal portion with a pocketing defect and distal to it a narrowing indicative of an ulcer crater with spasm and edema.

One of the most valuable procedures developed during the last ten years is the visualization of the rugal pattern of the stomach, duodenum, and jejunum. Because of the natural irregularity of the rugae, identification of a crater is not always simple but persistence and consistency of location of a rounded or elliptical area of density throughout the fluoroscopic examination and in the films is conclusive evidence. The procedure is especially valuable in the posterior wall gastric ulcer which so often evades scrutiny of the films alone. The most important sign of malignancy in a gastric lesion is rigidity of the adjacent stomach wall, best observed fluoroscopically. The location of the lesion is a contributory though not a decisive factor in this respect.

The author concludes her discussion of x-ray studies in the detection of ulcer by stating her opinion that one of the fundamentals of good gastroenterology is complete familiarity with fluoroscopy and film reading.

Treatment of peptic ulcer is dependent to some ex-

tent upon the location of the ulcer. The rare esophageal ulcer just proximal to the cardia seems to bear no relationship to carcinoma and is therefore amenable to medical management. As to gastric ulcer, the author is not in agreement with those surgeons who advocate resection in all cases. She regards the unhealed ulcer and the recurrent ulcer on the gastric side of the pylorus as the real threats to safety. A benign gastric ulcer should heal under proper medical management in three to five weeks, but the patient should be checked thereafter every six months for two years and then once every year as long as he lives unless symptoms recur, in which case immediate examination is imperative. All recurrent ulcers, however benign in appearance, should be resected.

In the matter of differentiating between duodenal ulcers that may be treated medically and those that require surgery, several pertinent points are discussed, including the proposition that in ulcer with multiple hemorrhages surgical resection may prove to be as unsatisfactory as medical treatment. There is some discussion of vagotomy and it is concluded that this method should be used only when other methods have failed, that it is too early to estimate the benefits obtained and the possible ill effects on other abdominal organs.

The principles of medical treatment laid down by Sippy, namely rest and neutralization of free acid, are still basic.

ALTON S. HANSEN, M.D.

**Symposium on Diverticula of the Digestive Tract**  
**Diverticula of the Esophagus** Manuel M. Ramos Mejia. *Prensa méd.* argent 34: 1683-1689, Sept 5, 1947.  
**Gastric Diverticulosis** Miguel A. Chavarrri. *Ibid.*, pp 1689-1696.  
**Duodenal Diverticula** Victorino D'Alotto. *Ibid.*, pp 1696-1705.  
**Diverticulosis of the Small Intestine** Angel M. Centeno. *Ibid.* pp 1706-1710.  
**Diverticulosis of the Appendix** Pedro A. Maissa. *Ibid.*, pp 1710-1712.  
**Diverticula of the Colon** Carlos F. Portela. *Ibid.* pp 1712-1717.  
**Solitary Diverticulum of the Cecum** Raul R. Perazo. *Ibid.*, pp 1717-1719.  
**Diverticulosis of the Sigmoid** Arturo Richieri. *Ibid.* pp 1720-1730.

The issue of *La Prensa Médica Argentina* dated Sept 5, 1947, is devoted to a symposium on diverticula of the digestive tract, under the direction of Prof. Carlos Bonorino Udaondo, Director of the National Institute of Gastroenterology. The eight articles listed above are included in the symposium.

Ramos Mejia presents in comprehensive detail the classification of esophageal diverticula and reports not only the pathological and etiological findings and symptoms, but also the diagnosis, stressing radiology and esophagoscopy. Numerous excellent illustrations illuminate this well-written chapter.

In the discussion of gastric diverticulosis by Chavarrri, the classification of Rivers, Stevens, and Kirklin (*Surg. Gynec. & Obst.* 60: 106, 1935; *Abst. in Radiology* 24: 647, 1935) has been followed. Stress is laid upon the radiological diagnosis. Gastric endoscopy gives supplementary information. Rarely are there any complications; nevertheless they have been described in the way of inflammatory reactions, hemorrhages, and neoplastic degeneration of diverticular sacs. Recurring diverticulitis and diverticular hernia suspected of malignant change are formal indications for operative intervention.

The contribution by D'Alotto is a complete description of duodenal diverticula, which is difficult to abstract. The information is factual, summarizing our knowledge up to date on the subject. Before attributing to the diverticulum any pathological importance in the causation of symptoms, one must discount the presence of ulcer or neoplasm or of gallbladder or pancreatic affection. If there is no other disease and one finds a diverticulum of the duodenum, then one may consider it as possibly responsible, especially if it is large and if it retains its contents. Initial treatment is medical. An ulcer regimen should be instituted with the addition of atropine; postural drainage may have some value. Operation is indicated only rarely, but it should be done when the symptoms persist and the pain is intense, or if there has been penetration into the pancreas, repeated hemorrhage, or perforation.

Diverticula of the jejunum and ileum are rarely found. Centeno goes into considerable detail from the historical and statistical standpoints. Diagnosis can be made only by x-ray. Although the ordinary radiographic study of the intestine may reveal diverticula, the use of spot films as emphasized by Maissa is a most important means of diagnosis. Diverticula of the small intestine may escape detection if studied during an inflammatory phase of diverticulitis.

True diverticulum of the appendix is rare; false diverticula are more infrequent. Maissa found only one appendiceal diverticulum in 10,000 serial examinations of the digestive tract. He quotes Stout as having found 5 in 264 examinations of the appendix in the Presbyterian Hospital in New York City, and McCarty as giving an incidence of 17 in 5,000 appendices. The frequency probably varies from 0.5 to 2.0 per cent. In the author's case there was an associated tuberculosis of the cecum and ascending colon.

Portela presents an excellent summary of the historical, pathological, and radiological facts relative to colonic diverticulosis and diverticulitis. The treatment recommended during an acute attack includes rest in bed, warm applications over the abdomen, atropinization, soft non-residue diet, adequate fluids, and oil enemas to be retained. Penicillin and sulfa, especially sulfaguanidine and sulfathaladine, should be employed. Complications, such as perforation into the free peritoneal cavity, must be dealt with individually.

Solitary diverticulum of the cecum is discussed by Perazo. This is of extreme rarity as compared with generalized diverticula of the colon. There is no unusual symptomatology for cecal diverticulitis. The lesion may be acute or chronic. It is practically impossible to differentiate between various acute affections of the abdomen found in the right iliac fossa and true pelvis with ordinary x-ray studies.

Richieri devotes considerable space to the historical origin and details of the frequency of occurrence of diverticulosis of the sigmoid colon. Radioscopy will reveal the different grades of spasm or hypermotility of the involved sigmoid. The lumen of the sigmoid is much reduced because of fibroplastic or spastic reaction producing different degrees of obstruction. Contrary to what happens with carcinoma, the intestinal segment involved by diverticulitis is ordinarily extensive and there is no sharp line of demarcation between the healthy and affected portions, whereas in carcinoma the demarcation is quite clear. Sigmoidoscopy is occasionally valuable but should be used with care.

JAMES T. CASE, M.D.

**Significance of the Relief Picture in Cases of Carcinoma of the Stomach** N H Krsnapoller Acta radiol 28 352-354, Aug 30, 1947 (In German)

Carcinoma of the stomach will show in the beginning only changes in the relief pattern of the rugae. These early changes in the course and appearance of the rugae are primarily determined by the location of the tumor and the type of infiltration of the stomach wall.

Difficulties in the early diagnosis of carcinoma of the stomach are often due to improper technic in taking roentgenograms, where the radiologist overlooks the fact that the anterior and posterior wall of the stomach are superimposed, thus making it practically impossible to distinguish between them when projected. One case is cited by the author by way of illustration of this diagnostic difficulty. At fluoroscopy, a large irregular crater was seen in the antrum of the stomach with a 1-cm zone of decreased density. The rugae were thick posteriorly and showed definite signs of defects. A provisional diagnosis of malignant tumor of the antrum was made. Spot films in the prone position, however, revealed a different course of the rugae, diverging from a center without interruption of the folds. These roentgenograms had the appearance of a large chronic ulcer.

The difference in the diagnosis in this case was explained solely by the projection, and the tentative diagnosis of a malignant tumor of the antrum with ulceration was confirmed by surgery and a biopsy report.

EUGENE F LUTTERBECK, M D

**Volvulus of the Stomach** Leonard Cardon Regina S Greenebaum, and Julian Arendt Ann Int Med 27 455-467 September 1947

Volvulus of the stomach is seldom considered in the diagnosis of acute abdominal disease, though it may produce symptoms as sudden and violent as the more familiar volvulus of the intestine. When the entire stomach rotates upon itself the condition is known as "total" volvulus. Partial volvulus occurs when one portion of the stomach twists on another portion.

Whether or not rotation of the stomach produces symptoms depends upon the extent of disturbance in its peristaltic movements, secretion, and circulation. The tremendous gastric distention found in cases of volvulus is a consequence both of the inability of the stomach contents to escape because of the torsion and hypersecretion of fluid and of the transudation of serum resulting from the disturbed circulation. These mechanisms explain the pain as well as the enormous amount of fluid in the stomach.

Sudden onset of excruciating pain high in the abdomen, especially in its left upper quadrant with or without a visible and palpable mass, and repeated emesis without bile in the gastric contents followed by non-productive retching, should suggest the possibility of volvulus of the stomach. A history of immediately preceding sudden increase in intra abdominal pressure, absence of peritoneal irritation, and a normal temperature, pulse rate and leukocyte count tend to confirm the diagnosis. In some cases where a fold is produced near the cardia by the torsion, it may be impossible to pass a stomach tube. This may be of diagnostic value.

The essence of the active treatment of gastric volvulus is decompression of the stomach by medical or surgical means. The first step should be an attempt at gastric aspiration and lavage. If successful removal of the stomach contents may permit the organ to untwist

itself. Since volvulus may produce an obstruction near the cardia, passage of the stomach tube should be performed with the greatest caution. If the stomach cannot be emptied and if signs of obstruction and strangulation increase, operation is imperative.

Two cases of volvulus of the stomach—one in a 74-year-old male and the other in a 35-year old female—are described in detail. In the first case the volvulus was complete; in the second partial. Roentgenograms accompany these reports. STEPHEN N TAGER, M D

**Congenital Defect of Left Diaphragm with Volvulus of Stomach and Transposition of Viscera** E Owen-Lloyd and Demiol Roberts Brit M J 2 485-487, Sept 27, 1947

The author reports a case of congenital diaphragmatic hernia which is of interest first because of the difficulty in establishing, radiologically, the exact size and nature of the defect in the diaphragm, and its operability, and secondly, because of a sudden and inexplicable volvulus of the stomach together with a transposition of the viscera whereby the herniated intestines underwent spontaneous reduction into the abdominal cavity, and the dilated stomach, which had previously been normally placed, was transposed into the thorax.

The patient was admitted at the age of eight weeks. Breathing had been difficult from birth and there were frequent attacks of cyanosis. Dyspnea appeared to be worse after feeding. Vomiting was an early symptom, and was invariably followed by relief of the respiratory symptoms. There was a suggestion of asymmetry of the chest wall, with the left side possibly a little more prominent than the right. On percussion of the chest, there was a dull tympanic note, breath sounds were absent, and there were occasional harsh grating sounds together with gurgling sounds somewhat similar to those of intestinal peristalsis.

An anteroposterior film of the chest showed a marked displacement of the heart to the right. The whole of the left side of the thorax showed loculated radiolucent shadowing, and there was complete absence of any normal lung pattern. The medial half of the left dome of the diaphragm appeared normal in position but the outline of the lateral half could not be defined. The air bubble in the cardiac end of the stomach was seen below the diaphragm and showed a normal rounded outline. Following a small barium meal, the esophagus was seen to be displaced to the right but appeared to open into the cardiac end of the stomach in the normal position. The stomach was large but showed good contraction and was empty in about four hours. The duodenum led directly into the thoracic cavity at a point just lateral to the center of the left dome of the diaphragm and appeared to be taut. The left side of the thorax was later seen to contain all the remaining bowel except part of the descending colon leading down to a normally situated rectum. The right dome of the diaphragm moved normally. Movement of the diaphragm on the left side was limited but not paradoxical. Except for enlargement of the stomach the condition remained little changed after a period of five months.

Death occurred suddenly, at the age of eight months. Autopsy showed the whole of the small and the large bowel situated in the abdominal cavity while an enormously distended stomach occupied the whole of the left and encroached on the right thorax. There was a volvulus of the stomach, the pyloric end having rotated a half circle so that the stomach was inverted with its

posterior surface facing forward, its greater curvature lying underneath the first rib, and the fundus resting on the thoracic aspect of what was present of the left diaphragm. There was a large oval opening in the left diaphragm occupying most of the posterior half.

The author concludes that the cause of death was cardiac embarrassment due to the pressure of the twisted, obstructed, and distended stomach, and describes the sequence of events leading up to this condition.

EDSEL S REED, M D

**Duodenal Regurgitation** Arthur R Metz Arch Surg 55 239-245, September 1947

Duodenal regurgitation is usually due to pressure on the duodenum where it passes over the spine, by the mesenteric attachment. It may also be produced by malrotation of the intestine due to congenital anomaly, tumor or adhesions. It has been estimated that 0.5 per cent of gastro-intestinal x ray studies show evidence of this disorder. The present report is based on 18 cases, 14 of which were successfully operated upon.

Symptoms vary with the degree of obstruction. Where the obstruction is slight, there are recurrent attacks of nausea, disturbed appetite, loss of weight, and weakness. With increase in the degree of obstruction, the attacks of nausea become more frequent and are followed by a sense of right upper quadrant fullness and by vomiting, coming on immediately after eating. Some patients have a definite upper abdominal pain. Loss of appetite, pernicious vomiting, dehydration, emaciation, exhaustion, and death may ensue.

A positive diagnosis is usually made by careful fluoroscopic examination. The duodenum is dilated. The barium stops to the right of the spine, then churns back and forth, and is finally regurgitated into the stomach. After five to ten minutes the barium may be forced past the spine, and it then may progress normally.

Treatment depends upon the degree of obstruction. In mild cases medical management may suffice, the object is to increase the weight of the patient, in the hope that the increase in intra abdominal fat may relieve the obstruction. If this is unsuccessful and in severe cases duodenojejunostomy or gastroenterostomy with occlusion of the pylorus should be done.

Prior to 1928 the author saw 4 cases in fifteen years without making the correct diagnosis. Two of the patients died. Since 1928 15 such cases have been successfully treated, 10 by gastroenterostomy and ligature of the pylorus and 5 by duodenojejunostomy.

LEWIS G JACOBS M D

**Duodenal Foreign Body** Goffredo Giannardi Radiologia med (Milan) 33 455-457 September 1947

Giannardi reports an unusual case of foreign body in the duodenum. Radiologic examination disclosed a radiolucent shadow within the second portion of the duodenum which could not be displaced by palpation. The foreign body was removed at operation and was found to be a toothbrush.

CESARE GIANTURCO M D

**Abdominal Abscess as a Cause of Intestinal Obstruction in the Newborn Infant** Julius B Richmond and Herbert R Moore J Pediatr 31 343-346 September 1947

This case is reported because of the infrequency of intestinal obstruction in the newborn resulting from an

inflammatory process. A large midabdominal mass was noticed on the first day of life. On the fourth day severe vomiting occurred, which became fecal. A roentgenogram showed distended loops of intestine in the left abdomen. At operation, numerous loops of small bowel were found bound to a cystic mass of fibrous material. Within the mass was a small amount of clear yellow fluid and there was a thick, gummy layer of purulent material beneath it. Grossly and microscopically the wall of the mass was inflammatory tissue, with no evidence of cystic lining. A culture of the material showed *E coli*. The postoperative course was uneventful.

The authors feel that this intra-abdominal abscess had its origin in intra-uterine life.

PAUL W ROMAN, M D

**Radiologic Diagnosis of Lesions of the Large Bowel** J R Maxfield, Jr Texas State J Med 43 276-279, August 1947

The author reviews in some detail most of the lesions of the colon demonstrable by radiologic methods. He emphasizes thorough familiarity with the normal and with congenital variations as a prerequisite to the diagnosis of pathological findings. He describes the findings in megacolon, bowel obstruction, volvulus, intussusception, ulcerative colitis, tuberculous colitis, lymphogranuloma inguinale, simple spastic colitis, diverticulosis and tumors of the colon.

Eight per cent of all carcinomas are found in the colon and their early detection is extremely important if cure is to be obtained. About 50 per cent of carcinomas of the colon are in the sigmoid or rectosigmoid. The differentiation between infections and benign and malignant lesions producing filling defects may not always be made. The size, shape, and position of the lesion are important. Malignant lesions are usually more sharply demarcated, frequently producing narrowing of the bowel lumen and distortion of the mucosal pattern. They are often of less total length than benign lesions. Adequate examination of the colon requires patience and persistence by the radiologist; it involves thorough preliminary cleansing of the bowel, the use of spot films whenever necessary, and the employment of accessory procedures such as double contrast air studies and the barium meal as indicated. The air studies should almost be routine, the author believes.

[The abstractor recommends this article as an excellent review of the subject, many details of which cannot be included here.] B S KALAYJIAN, M D

**Asymptomatic Hepatodiaphragmatic Interposition of the Colon: A Report of Two Cases** Alvin C Wyman Gastroenterology 9 213-216, August 1947

Two cases of interposition of the colon between the liver and the right hemidiaphragm are recorded. Neither patient had any symptoms referable to the interposition. History, physical examination, and gastro intestinal studies failed to reveal any evidence of disease.

Wyman feels that hepatodiaphragmatic interposition of the colon is of congenital origin and is not the result of intestinal disease. It is believed that faulty suspension of the liver on the basis of congenitally anomalous anatomic development of the hepatic peritoneal reflections allows the hepatic falciform of the colon to interpose, without alteration of intra abdominal pressure. The

presence of haustral markings in the gas shadow differentiates the condition from pneumoperitoneum. Bulging of the diaphragm and secondary pulmonary changes, such as are noted in subphrenic abscess or cysts are not usually seen in interposition of the colon.

Two cases are cited from the literature in which interposition of the colon was discovered at operation for an acute abdominal emergency. Schenck (Arch Surg 36 766, 1938) reported a case of perforation of the pylorus with free gas and fluid in the right subphrenic space observed roentgenographically. Pendergrass and Kirk (Am J Roentgenol 22 238, 1929) reported a case of hemorrhagic pancreatitis diagnosed preoperatively as perforation of an abdominal viscus because the interposed colon was erroneously interpreted as free abdominal gas.

ROBERT C PENDERGRASS M D

## THE MUSCULOSKELETAL SYSTEM

**Multiple Myeloma. A Survey Based on Thirty-Five Cases, Eighteen of Which Came to Autopsy.** Louis Lichtenstein and Henry L Jaffe. Arch Path 44 207-246 September 1947.

This study based on 35 proved cases (18 by autopsy), places emphasis on the clinical and anatomic features that characterize multiple myeloma. The authors conceive of the condition as a distinctive malignant disease of the skeleton primarily which apparently takes its departure from the myeloid formative tissue proper. Anatomically practically every bone may ultimately come to be involved more or less in a given case.

The great majority of the patients in this series were between forty and sixty years of age. The sex distribution indicates that multiple myeloma may be slightly more prevalent in males than in females but does not support the oft repeated statement that it is at least twice as frequent in males.

In a consideration of other neoplasms of hemopoietic derivation, the authors stress the diagnostic significance of hypercalcemia, hyperglobulinemia (and its associated hematologic manifestations) and Bence Jones proteinuria, the not infrequent presence of atypical amyloidosis in association with myeloma and the well known cytologic renal changes of almost pathognomonic distinctiveness. They believe that the possibility of myeloma should be investigated in every case of idiopathic amyloidosis even though the bones present no evidence of tumor either roentgenographically or on gross inspection at necropsy.

In regard to the roentgen findings the authors found that the picture conventionally held to distinguish multiple myeloma, i.e. many bones, including the calvarium riddled by clear-cut punched out osteolytic defects represents the exception rather than the rule and applies only to certain cases in which the disease is far advanced. Indeed very often one observes merely some vaguely defined rarefactions in a number of the bones or a single exuberant tumor focus in some one bone (commonly a femur or humerus but sometimes a vertebral body, a rib or a clavicle in innominate bone, a bone of the calvarium) without obvious involvement of the skeleton generally. Sometimes when myelomatous infiltration is diffuse skeletal changes may not be apparent at all roentgenographically or the replacement of the marrow by tumor may be reflected merely by some osteoporosis. As for the calvarium this not infrequently fails to show numerous punched out rarefactions even when roentgenograms show clear-cut and

widespread involvement of the rest of the skeleton. In such equivocal or initially obscure cases, one must utilize fully all the available diagnostic cues to arrive at a combination of significant findings constituting probable or conclusive evidence of multiple myeloma.

**Roentgen Appearance of Primary Reticulum Cell Sarcoma of Bone.** Robert S Sherman and Ruth Evelyn Snyder. Am J Roentgenol 58 291-306, September 1947.

This is a report of a series of 17 cases of primary reticulum-cell sarcoma of bone. The diagnostic features and radiation treatment are discussed.

The findings indicate that primary reticulum-cell sarcoma of bone is a radiosensitive tumor presenting constant features of single bone involvement, medullary origin, medullary and cortical bone destruction, ill defined borders, and characteristic changes in the roentgenogram following roentgen therapy. The tumor tends to grow in the medullary portion of the bone with relatively small periosteous extension. Its osseous structure shows fairly regularly the presence of patchy areas of destruction often accompanied by areas of production with an absence of calcification in the periosteous portion of the tumor. Reticulum-cell sarcoma occurring at the ends of the tubular bones tends to be ovoid in configuration, in the shaft it is fusiform. Periosteal reaction is absent or moderate and when present is of the lamellated type. There is a predilection for the long bones with over 40 per cent of the total cases being located about the knee. In those tumors occurring about the knee synovitis is not uncommon. In the series reported here, pathological fractures were present only in tumors of the mid-shaft of a long bone or in a vertebra. Reticulum-cell sarcoma seems to be a moderately active tumor.

All of the 17 cases were treated with roentgen therapy. In one case local resection preceded irradiation, in another amputation followed roentgen therapy. In this latter case no viable residual tumor was found by multiple sections of the involved area. Three of the 17 patients are dead. One died of tuberculosis the cause of death of the other two was not determined. The remaining patients are alive and well. The longest follow-up is eleven years. Several have been followed less than a year.

G K VOLLMAR M D

**Importance of the Radiological Investigation of Bones in Congenital Syphilis.** Francisco Borges y Hernández and Raul Pereiras y Valdés. Rev cubana de pediat 19 525-538 September 1947.

This very interesting work by Drs Borges and Pereiras may be summed up as follows. Lack of clinical and serologic findings in the early months of life does not exclude syphilis which may appear somewhat more tardily than usual. The osseous system of a syphilitic fetus, beginning in the fifth month of pregnancy, is always affected by the spirochete, which acts upon the cartilaginous bones. Osseous lesions are found in the great majority of nurslings of syphilitic mothers and can be demonstrated radiologically. An intense positive serology coincides with the radiological findings in virulent syphilis in the experience of these authors, although in cases reported in the literature this was not always so. In many cases radiological study reveals osseous lesions in patients with negative serologic tests and no clinical symptoms.

Although it is recognized that the study of eight cases does not constitute a substantial basis for statistical deductions, the authors conclude from their observations that radiological investigation should constitute one more means of establishing a diagnosis of congenital syphilis. Radiography should be considered as a routine investigation in every suspected case of congenital syphilis in children less than six months of age. When the findings are negative, the investigation should be repeated up to six months after birth. The importance of clinical and radiographic examination in the first few weeks of life is stressed, and radiography by itself is held to constitute an investigation of decisive value in the diagnosis of congenital syphilis of the nursing

JAMES T. CASE, M.D.

**Osteopetrosis Albers-Schönberg Disease (Marble Bones)** Report of a Case and Morphologic Study. Bernard Pines and Max Lederer. *Am J Path* 23: 755-781, September 1947.

Following a discussion of the salient anatomic and roentgenographic features of marble bones and a review of the incidence and etiology of this disease, an illustrative case in an infant is reported. Roentgen examinations of the entire skeleton were made at monthly intervals from three weeks of age until death at eighteen months. The first films showed increased density of the bones of the entire skeleton, slight periosteal thickening, and roughening of the metaphyses of the long bones. The skull showed a similar increase in density, especially at the base. There was wide separation of the bones at the suture lines. Subsequent studies showed progressively increasing condensation. At six months the metaphyses and epiphyses were developing normally. The long bones were wider than normal and of irregular contour. The cortex of the bones appeared to be less sclerotic than the remainder. Radiolucent striae were seen in the long bones, vertebrae, ribs, and pelvis. Some clubbing of the distal ends of the radius and ulna and of the proximal ends of the tibia was seen. The ribs also showed increasing density, the cortex, like that of the long bones, appeared broad, irregular and less dense than the medulla. In places the entire width of the rib appeared to have the consistency of the less opaque cortical bone. Just distal to the tubercles of each of the first ten ribs on both sides were single radiolucent striae. The most lateral portions of the bodies of the upper right ribs bilaterally showed sharp angulation. Postmortem roentgen examination showed these angular deformities apparently to be due to fractures situated about 2.5 cm. lateral to the costochondral junctions. The lateral portions of the 9th, 10th and 11th ribs on both sides were also the seat of healed fractures but without angulation. The callus at the sites of all of the fractures consisted of less densified bone of the same radiographic consistency as the cortical bone.

A detailed study of the histomorphology of representative bones of the skeleton revealed changes in the epiphysis, metaphysis, diaphysis and cortex which appear to confirm the concept that the pathogenesis of osteopetrosis is related to disordered vascular and osseomedullary anlage.

There is no apparent resemblance of the histologic structure of the bones in osteopetrosis to that in other bone conditions which have been associated in the literature with the pathogenesis of the disease: rickets, osteomalacia, syphilis, non specific inflammatory disease, phosphorus and fluorine intoxication, and osteosclerosis produced by estrogenic hormones.

Bone fragility in marble bones is due to the disproportion of mineral to organic substance, the poor quality and arrangement of the organic elements of the bones, the uncontrolled variability in size and shape of the bone trabeculae, and their purposeless architectural arrangement.

**Osteogenesis Imperfecta A Study of Five Generations** Cal S. Kellogg. *Arch Int Med* 80: 358-365, September 1947.

The occurrence of osteogenesis imperfecta in a family of 17, representing five generations, is reported. Roentgenographic studies were made on 9 of the 17, representing four generations. Of this number, 5 had evidences of recent or old fractures, and their bones showed the typical changes of osteogenesis imperfecta, in the other 4 cases the bones were normal in appearance, although the patients revealed some of the other characteristics of the disease.

The members of the family showed the usual stigmas of osteogenesis imperfecta—blue sclerae, brittle bones, deafness and hypertonicity of the ligaments. There was also a high incidence of exophthalmos.

**Morquio's Disease Clinical and Radiological Diagnosis** Lorenzo Expósito, Argelio de Faria, and Hugo González. *Rev cubana de pediat* 19: 447-462, August 1947.

The author presents two cases of Morquio's disease. One patient offered a complete picture of this dystrophy: spontaneous pains localized in the joints of the lower extremities, painful and unstable gait, shortness of stature in relation to age, thoracic deformities. Two brothers of the patient presented similar signs. In the second case the symptoms were in an initial stage but characteristic changes of the disease were evident in lateral roentgenograms of the spine, demonstrating the great value of this method of investigation. The patient's father and grandfather were of short stature and the father showed other skeletal abnormalities. Articular movements were limited in the first case but not in the second.

Roentgenograms are of aid in the differential diagnosis and permit adequate treatment at an early stage for the better correction and elimination of the factors of invalidism.

JAMES T. CASE, M.D.

**Gargoylism Review of the Literature and Report of the Sixth Autopsied Case with Chemical Studies** Reuben Straus, Reuben Merliss, and Raymond Reiser. *Am J Clin Path* 17: 671-694, September 1947.

A case of gargoylism is presented with detailed clinical, x-ray, postmortem and chemical studies.

Evidence suggests that the deformities may be produced by a disease of collagenous connective tissue, chiefly affecting the fascia and ligaments rather than by an abnormality of bony growth as previously accepted. It is believed that abnormalities are probably inherited by congenital factors, chiefly because of the high familial incidence of the disease.

It is shown that lipoidosis is not a constant feature of the disease entity. When present, it is found in the brain and in the reticulo-endothelial system as in other idiopathic lipoid dystrophies. Chemical analysis of the

diseased unless either the nucleus pulposus had ruptured through the annulus fibrosus and was lying free in the extradural space, or there was a definite bulge into the spinal canal with spontaneous eruption of nuclear material on opening the annulus. Eighty of the cases fulfilled one of these criteria, and 10 not fulfilling them were classified as "negative." The lesion was between L3 and L4 in 6 cases, between L4 and L5 in 28, and in the lumbosacral interspace in 46. The only 2 patients with paraplegia had herniations at the third lumbar interspace and in both the result of operation was unsatisfactory, with residual weakness and severe sensory changes. This agrees with the observations of others that damage to the cauda is seldom completely repaired.

No significant difference in symptomatology was noted between the 80 "positive" and 10 "negative" cases. Routine roentgenograms were taken in all, 7 showed sacralization, 1 spondylolisthesis, and 1 spina bifida occulta. The involved interspace was narrowed in 16, in 8 an adjacent interspace was narrowed, and in 3 a narrowed interspace was not accompanied by operative findings of disease. Myelography with pantopaque was done in selected cases only where it was thought that it might aid in the diagnosis, in 46 such trials the diagnosis was correct in 41, in 1 other a doubtful lesion was found at the correct level. In 3 a diagnosis made on the films was not confirmed at operation and in 1 a negative finding on the films was associated with a large disk herniation at operation. Of 72 patients, 62 had a satisfactory result from operation, of the 10 "negatives" none had a satisfactory result.

LEWIS G. JACOBS, M.D.

**Relations of Nerve Roots to Abnormalities of Lumbar and Cervical Portions of the Spine.** J. Jay Keegan. *Arch Surg* 55: 246-269, September 1947.

The finding of hypalgic areas accompanying damage to a single nerve root has made it possible to map more accurately the sensory distribution in relation to the vertebral sequence. New dermatome charts for the trunk and extremities are presented, based on this study. By relating an accurate history of pain distribution to these charts in cases of compression of a single root by posterolateral disk herniation an accurate localization may generally be made. A very important observation is the fact that there does not appear to be any change in the nerve distribution in patients with addition or reduction of the number of segments in any portion of the skeleton provided the distribution is correlated with the nerves counted numerically in sequence from above down without regard to the presence or absence of ribs or which segment constitutes the first sacral segment. The plexus formation for innervation of the limbs does not alter the distributions as plotted on the charts. Vertebral abnormalities as seen in the x-ray studies should be interpreted independently of the pain, if the latter is definitely localizing it has proved more accurate than the x-ray localization. [This article would repay reading in the original, especially for those interested in the problems of disk herniations.—L. G. J.] LEWIS G. JACOBS, M.D.

**Case of Osteonecrotic Vertebra Plana (Juvenile Vertebral Osteochondritis) or Calvé's Disease.** Marc Neyroud. *Schweiz med Wchnschr* 77: 1000-1003, Sept 13 1947.

This case is reported because of the completeness of the series of films the first study being made three

weeks after the onset of lower back pain in a boy 4½ years old. At this time there were irregular osteolytic changes in the third lumbar vertebral body. Three weeks later the body had collapsed. In about five months the vertebral structure had again become homogeneous, with residual deformity. The adjacent intervertebral disks were widened and both clinically and radiologically the case was thought to fit into the classification of juvenile osteochondritis. The roentgenograms are reproduced rather poorly.

LEWIS G. JACOBS, M.D.

**Klippel-Feil's Syndrome Associated with Compression of the Spinal Cord by an Extradural Hemangiolipoma.** Paul C. Bucy and Hardin Ritchey. *J Neurosurg* 4: 476-481, September 1947.

The case is reported of a 33-year-old man with a Klippel-Feil deformity who in the course of ten weeks showed signs of compression of the upper thoracic spinal cord, progressing rapidly to a total paraplegia. Laminectomy disclosed an extradural hemangiolipoma which was partly removed and then treated with roentgen rays (a total of 2,050 r). Complete recovery followed. This is the first case recorded of an extradural mass compressing the spinal cord in association with this malformation of the cervical spine.

**Further Work on the Study of Carpal Varieties.** Theo Marti. *Schweiz med Wchnschr* 77: 890-891, Aug 23, 1947.

The author reports three anomalies of the wrist. The first patient had two extra bones, one at the dorsal radial distal end of the lunate near the navicular and capitate (the epilunate) and one in the ulnar portion of the wrist between the lunate, triquetrum and hamate (the epipyramis). The second case presented a proximal carpal row, consisting of three elements only: bilaterally, the lunate and triquetrum were fused. In the third case there was a bilateral absence of the navicular, with only a single row of carpal bones. The hamate was fused with the bases of the fourth and fifth metacarpals and the capitate with the second. The lesser multangular was represented by a tiny ossicle only, while the greater multangular was apparently partly fused to the bases of metacarpals three to five.

LEWIS G. JACOBS, M.D.

**Acute Osteoporosis of Sudeck as a Sequel of Carpal Traumatism Incurred at Work.** Francisco Fernández Rozas. *Prensa med argent* 34: 1774-1785, Sept 12 1947.

Acute osteoporosis, or Sudeck's atrophy, is a more frequent sequel of injury to the wrist than is generally believed, and one which may produce serious incapacity if it is not diagnosed and treated in time. It may follow minor injuries as well as more extensive trauma in the form of fractures, dislocations, etc. The author describes the radiographic picture as "spotted" or "speckled." The contours of the bone, due to the decalcification, are clearly visible producing the impression of a shell wholly or partially emptied of its contents. The bony architecture appears veiled or, better, "shaded" as if the film were dirty or stained. The only condition which is apt to cause confusion in the diagnosis is tuberculous osteoarthritis.

This syndrome should be regarded as carrying a conservative prognosis. Passive motion, prolonged im-

mobility, and massage are all contraindicated. Well planned treatment with systematic periodic x-ray examinations will eliminate the lesions. Stress is laid upon the aphorism that there is no such thing as acute bone atrophy without pain.

A number of roentgenograms are reproduced and case histories are appended.

JAMES T. CASE, M.D.

**Unilateral, Congenital Synostosis of Lunate and Triangular Bones.** George Hammond. *Surgery* 22:566-567, September 1947.

The rather unusual anomaly of fusion of the lunate and triangular bones was an incidental finding in an x-ray examination of a soldier for a fracture of the proximal shaft and base of the fifth metacarpal. The opposite wrist was normal.

**Congenital Dislocation and Congenital Subluxation of the Hip. Etiology and Roentgenographic Features.** Vernon L. Hart. *Minnesota Med* 30:889-896, August 1947.

The author's main point is that classical congenital dislocation of the hip is secondary to a genetic dysplasia of the acetabulum and develops during intra-uterine life or in the course of the first or second post-natal year. Aplasia or hypoplasia of the roof or buttress of the rim of the acetabulum causes a flat socket, which is the important expression of the dysplasia of the pelvis and hip joint. Dislocation of the femoral head may result because the hypoplastic and insufficient roof of the acetabulum lies in the axis of transference of forces of body weight and muscle contraction. Actual dislocation, however, need not necessarily occur. It is now an established fact that dysplasia of the hip with subluxation which was formerly thought to be only a precursor of the classical dislocation, may remain as a permanent deformity with characteristic clinical symptoms and roentgenographic findings.

The roentgen features of the dysplastic hip are described in detail. The primary finding is the abnormal acclivity of the roof of the acetabulum which increases the angle of incidence of the roof of the socket. Other significant features are an increased distance between the upper femoral diaphysis and the acetabular floor and hypoplasia or delayed development of the epiphyseal nucleus of the femoral head. Because of the repeated trauma resulting from abnormal sheering forces, mechanical instability and incongruity of the dysplastic hip, secondary changes are added to the primary features. Abnormal development of bone and soft tissues and arthritic sequelae are the result.

In the discussion Dr. Rigler made the important point that when the dislocation is reduced early in life a well formed acetabulum may often be obtained as a result of the weight bearing thrust of the femoral head.

PERCY J. DELANO, M.D.

**Tuberculosis of the Great Trochanter.** Barry McMurray. *Brit M J* 2:492-494, Sept 27, 1947.

The author reports a series of 12 cases of tuberculosis of the greater trochanter. The average age of the patients, excluding two aged seven and fourteen, was twenty-eight years. Trauma was believed to be a possible etiologic agent in three instances. Only 5 of the group, or 42 per cent, had any other demonstrable tuberculous lesion.

It has been suggested that tuberculosis of the great trochanter is primarily a tuberculous epiphysitis, comparable to tuberculous epiphysitis in other situations, but the author believes that the condition does not invariably arise in the bony tissue. He observed two types of lesions radiologically: first, and commonest, erosion of the periphery of the greater trochanter; second, the encysted form, arising in the medulla of the greater trochanter. Five of the patients had no bony change visible radiologically. In these and in the patient with the encysted form, sinuses had not developed and secondary infection was therefore excluded. All the other patients showed erosion of the bone and also had sinuses. Two other general factors militate against the theory that the primary lesion is always situated in the bony tissue: (1) It is extremely unusual for extra-articular tuberculosis to start by erosion of the cortical surface of the bone substance from without, and there is no comparable lesion described in any other situation; (2) In all the radiographs of peripheral erosion there is definite evidence of sclerosis and this is undoubtedly due to the secondary infection which is present.

In view of these observations the author believes that when there is radiological evidence of peripheral erosion of the greater trochanter the bone lesion is secondary to tuberculous infection of the trochanteric bursa and begins only after secondary infection has occurred. He believes that the single encysted lesion in his series was the only one in which the infection arose primarily in the bone.

The following conclusions are drawn: (1) that tuberculosis may originate either in the great trochanter or more commonly in the overlying bursa; (2) that in tuberculosis of the greater trochanter bursa, erosion of the bone does not usually occur until secondary infection has taken place; (3) that the best treatment of tuberculous bursitis is early and adequate excision.

EDSEL S. REED, M.D.

**Chordoma. A Sacrococcygeal Type Case Report.** Arthur H. Wells, Arnold O. Swenson, and Harold H. Joffe. *Minnesota Med* 30:863-866, August 1947.

A man of 87 was seen with a mass over the sacrum. It had first appeared some twelve years earlier following an automobile accident in which he had suffered a bump on the back. Roentgen examination revealed a soft-tissue mass in the pelvis, inferior and posterior to the os ischium. There was destruction of the inferior portion of the sacrum and coccyx. The changes were osteolytic.

The mass was removed surgically and was diagnosed histologically as a chordoma. It measured 10 × 21 × 23 cm and was covered by a capsule everywhere except at its attachment to the sacrum.

A discussion of the origin of chordomas and their pathologic and clinical manifestations is presented.

PERCY J. DELANO, M.D.

**Fractures of the Os Calcis. Preliminary Report.** A. H. Whittaker. *Am J Surg* 74:378-379, September 1947.

Fracture of the os calcis is frequent and there has been difficulty in obtaining a good functional result. The fracture is produced by the foot striking the ground in a pronated position with the tuberosity of the os calcis outward, backward and downward. The tuberosity tends to be carried upward, outward and forward, resulting in displacement of the sustentaculum downward.

and along the arch. On the medial aspect the displacement of the fragments and interposition of the brittle fragments of the cortical bone block anatomical reposition. The cortical fragments are rotated and driven into the cancellous portion.

During the past year the author has performed open reduction upon the os calcis with removal of the cortical fragments and restoration of good anatomical alignment. By this procedure immediate and permanent disability has been reduced.

WILLIAM R. ALLEN, M.D.

## GYNECOLOGY AND OBSTETRICS

**Effect of Body Posture on Uterine Position.** A. W. Diddle, William F. Mengert, and Ruth Maxwell Sanders. *Am J Obst & Gynec* 54: 391-399, September 1947.

The authors ingeniously demonstrated the movement of the uterus by rendering the canal radiopaque by means of lightweight material. A correlation of the photographic and roentgenographic findings was used to determine the effect of body posture on the position of the uterus.

Their study makes it apparent that the station of the uterus (height of the cervix in the pelvis) and cession (distance of the cervix from the symphysis pubis) depend upon the soundness of fascial support. On the other hand, flexion of the uterus (bending of the uterine canal) and version (the rotation of the entire uterus around a transverse axis) are the result of the combined influences of its muscular tone, position of the intestines, body posture and perhaps the tilt of the pelvis. The study also demonstrates that the normal uterus tends to gravitate in conformity to the several positions assumed by the subject. This tendency is greatly exaggerated in patients with uterine prolapse.

JOHN DECARLO, M.D.

**Intravasation of Lipiodol During Uterosalingography.** Arnold D. Piatt. *Ohio State M J* 43: 821-824, August 1947.

The entrance of iodized oil into the venous plexus of the uterus and ovaries during uterosalingography presents a bizarre picture and is a harrowing experience for the physician. The reported incidence is 0.4 to 1.8 per cent. The results are usually not serious, death has been reported in only one instance. Pulmonary and cerebral oil embolism and pulmonary infarction are the most discussed complications.

Direct trauma to the endometrium by the cannula is probably the most common cause of intravasation. Excessive intra uterine pressure, pathological permeability of the receiving sinuses, uterine abnormalities (infantile uterus, uterus septus), injection too close to the menstrual period or following diagnostic curettage are among other causes which have been suggested. The use of some method whereby the pressure is known and controlled so as not to go above 200 millimeters of mercury is recommended. Injection under fluoroscopic control is used by many but considered unsatisfactory by others. The most propitious time is from seven to fourteen days after the last day of the menstrual period.

The author describes the appearance of the oil in the venous plexus and shows good illustrations of the case he reports. In this case as far as can be determined the oil

was injected without manometric or fluoroscopic control. Radiographs showed extensive extravasation in the venous plexus and up the iliac veins. Aside from lower abdominal pain and some perspiration, no abnormal symptoms were noted. Blood pressure, pulse, temperature, respiration and blood counts were normal. There was no respiratory embarrassment or cough. The pain subsided within one hour. Films made twenty-four hours later showed no oil in the veins and a normal chest. No complications arose from the procedure. The last day of the preceding menstrual period had been ten days prior to the injection and the period had been normal.

[The abstractor believes that the use of manometric control and/or fluoroscopic observation (preferably both) should be routine in doing this examination if further difficulty of this type is to be avoided.—B. S. K.] B. S. KALAYJIAN, M.D.

**Roentgen Diagnosis of Intrauterine Fetal Death.** Herbert Deuel Schweiz. *med Wchnschr* 77: 1003-1005, Sept 13 1947.

Generally the x-ray diagnosis of fetal death is made on the basis of skeletal changes: overlapping of the skull bones with a decrease in cranial size, sloping of the cranial vault, high grade asymmetry of the skull, falling together of the skull bones, high-grade asymmetry or crookedness of the vertebrae, lack of sharpness of the bony edges, etc. These signs however, are not invariably reliable, especially overlapping of the skull bones, which may be mimicked by projection. The author describes a new sign relating to the soft tissues, though this also, as he notes, may not be perfectly reliable. A film is made with soft-tissue technique, on this a bright streak can usually be seen forming a cap over the cranium. This represents the fat in the subcutaneous tissues of the scalp. After fetal death, the scalp tends to separate from the skull bones and an unusually wide space between the skull and the bright streak results. Four illustrations of this sign with brief case histories are shown.

LEWIS G. JACOBS, M.D.

## THE GENITO-URINARY SYSTEM

**Injuries Involving the Genitourinary Tract.** Walton K. Rexford. *Am J Surg* 74: 350-358, September 1947.

The author points out that for the most part industrial injuries to the genito urinary tract simulate those which have been reported since the last war, and the treatment is the same. The conditions discussed at length are rupture of the urethra and bladder and of the kidney. It is pointed out that the bladder can be injected with an opaque medium to make the roentgen diagnosis of rupture, as can the urethra, but this is often not necessary because the clinical diagnosis can usually be made with certainty. The roentgen examination is necessary to determine the state of the pelvis in cases of possible fracture.

In trauma to the kidney, the retrograde pyelogram may be normal, while the intravenous urogram may show a failure of function. Some cases in which this is the situation will show a return of function in several days but in others the damaged kidney will have to be removed. All cases of rupture of the kidney do not require nephrectomy, and the decision can be reached only after careful evaluation of the patient's condition and course.

JOHN O. LAFFERTY, M.D.

**Double Kidney Pelves and Double Ureters, Upper Ureter Ending Ectopically at Vestibule of Vagina. Case Report.** Luis F Torres, Jr J Urol 58 171-175, September 1947

This report of reduplication of the right kidney pelvis and ureter, with an ectopic ureteral orifice in the vestibule of the vagina, is recorded for the simple purpose of adding it to the literature of reno-ureteral anomalies. The patient's sole complaint was incontinence of urine, present since childhood. The anomaly was revealed by urologic and urographic studies and confirmed at operation. Transplantation of the supernumerary ureter to the bladder was unsatisfactory and a right nephrectomy was done with entire success.

**Aberrant Ureter. Preoperative Roentgen Diagnosis of Congenital Anomaly.** Paul C Schnoebelen, Hyman R Senturia, and Lawrence M Aronberg. South M J 40 644-646 August 1947

An aberrant ureter may terminate in the bladder or extravasically. Outside the bladder the opening is usually in the urethra or vagina in the female, and in the seminal vesicle, the prostatic urethra or rectum in the male.

The diagnosis of this condition involves a combination of urologic and roentgenologic procedures. The outline of the aberrant ureter may be visible in the intravenous pyelogram when there is sufficient kidney substance to secrete the dye. If the opening in the urethra or vagina is located, a retrograde pyelo-ureterogram makes the diagnosis clear.

The authors report a case in a young girl referred by her family physician because of weakness of the bladder. When the patient was five years old the parents consulted a physician for continued enuresis and also daytime wetting. A general and a local examination revealed nothing abnormal. At ten years of age a further examination failed to establish a diagnosis. At fifteen the patient was admitted for a general work-up and urological examination. After the usual procedures no diagnosis was made but an aberrant ureter was suspected. A repeat intravenous pyelogram failed to reveal a pathologic condition and was considered negative except that the large upper pole of the right kidney was not explained. At this time it was decided to place F-9 bougies in each ureter and repeat the intravenous pyelogram. They partially obstructed the normal flow in the ureters, and films were made in the routine manner. It was then that an anomalous pelvis and ureter were visualized on the right side, superior to the normal kidney pelvis and ureter. The distal end of the ureter was never seen in the urethra. Dye injected intravenously with a Foley bag obstructing the internal urethra returned to discolor the urine distal to the sphincter. At the same time a vaginal pack did not become discolored indicating an opening in the urethra. The patient was operated upon and an aberrant ureter and pelvis, arising from the upper pole of the right kidney, were discovered. The ureter was divided and each end tied separately. No attempt was made to do a heminephrectomy or partial nephrectomy. The patient has remained free from symptoms or complications.

The occurrence of ectopic ureter is not particularly common as there are only about 300 cases reported in the literature. The anomaly has been found much more often in the female than in the male.

BERT H MALONE, M D

**Primary Carcinoma of the Ureter.** Frederick Pilcher. Canad M A J 57 240-243, September 1947

There are approximately 200 cases of primary carcinoma of the ureter reported in literature. Pilcher presents 3 interesting cases in some detail, describing clinical progress, operative procedures, and pathologic findings, with follow-up notes on the cases as to date.

Ureteral tumors resemble bladder tumors microscopically, as well as in their clinical behavior. They are usually squamous-cell epitheliomas and have a papillary tendency. Tumors of a lower degree of malignancy tend to be multiple, whereas the more malignant growths are usually single. Since the ureters have a thin wall and a rich lymphatic supply, metastases readily occur, first in the regional retroperitoneal lymph nodes and after that in other nodes or organs. Hydro-nephrotic destruction of the kidney and dilatation of the ureter above the tumor depend upon the degree of ureteral obstruction by the tumor. More than half of all ureteral carcinomas occur in the lower third of the ureter.

Hematuria, though variable in nature, occurs in approximately 70 per cent of the patients. Pain of varying degree occurs in more than 60 per cent, from a dull ache to a typical renal colic. A mass is found in 40 per cent of the cases and is usually associated with hydronephrotic kidney. In some instances the ureteral tumor has been palpated by abdominal, rectal or vaginal examination. Metastatic masses may be found. Examination of the urine may show bleeding or pus cells if secondary infection has set in.

Retrograde pyelography will demonstrate constant filling defects. Excretory urograms are usually of no value since kidney function is usually impaired and the filling defects are not well outlined, if at all. A scout film may show a large hydronephrotic kidney on the affected side. Cystoscopically, bloody spurts of urine may be seen from the ureteral orifice and associated bladder tumors may be demonstrable. The filling defect in the ureterogram should be constant in repeated films to rule out blood clots or non-opaque calculi. Papillary tumors are likely to be multiple, with a dilated ureter above, but a solid infiltrating tumor may resemble a stricture and have a relatively smooth outline.

The treatment of primary carcinoma of the ureter is complete nephroureterectomy preferably in two stages, with removal of a cuff of bladder wall. Low grade tumors respond well to radical treatment while most of the patients with highly malignant neoplasms have died in less than three years. Radiotherapy can be considered only as a palliative procedure. Periodic cystoscopy is important in follow-up examinations.

WILLIS MANGES, M D

**Diagnosis and Management of Renal-Artery Thrombosis. Report of a Case.** William E Goodyear and Donald E Beard. New England J Med 237 355-358, Sept 4, 1947

Renal artery thrombosis is usually confused with an "acute surgical abdomen." The most important factor in diagnosis is to remember the possibility of thrombosis.

The patient appears acutely ill, with a slight elevation in temperature and severe, usually constant upper abdominal pain or pain in the flank. Nausea and vomiting may be present, but hematuria is rarely observed. The abdomen may be distended. Evidence

of vascular disease is usually present related to a generalized vascular sclerosis. The most important feature in diagnosis is retrograde and intravenous pyelography. In the early case retrograde pyelography shows no appreciable change in the urinary tract on either side. With intravenous pyelography, however, there will be failure to excrete the dye on the side of the thrombosis.

A 62 year old female, with a history of hypertension and a previous cerebral accident, had severe constant pain in the right flank with nausea and vomiting. There were no urinary symptoms. The abdomen was distended with tenderness in the flank. The heart was enlarged and irregular showing many premature ventricular contractions. The eyegrounds showed marked arteriolar constriction. Cystoscopically the bladder appeared normal, but no urine was seen coming from the right ureteral orifice. No urine was obtained from the right kidney on catheterization and indigocarmine was not returned from the right side. The roentgenograms showed marked calcification of the great abdominal vessels. An exploratory urogram showed good concentration of dye in the left kidney but none on the right.

A diagnosis of complete occlusion of the right renal artery was made and progressive studies by retrograde pyelography showed atrophy of the right kidney. The left kidney remained normal.

Catheterization of the right renal vein was performed as a diagnostic procedure. The catheter was introduced into the antecubital vein and passed into the subclavian vein and down the superior vena cava into the inferior vena cava. Under fluoroscopic control the right renal vein was catheterized but no flow of blood could be obtained from this vessel.

Autopsy showed a generalized arteriosclerosis with myocardial infarction and complete thrombosis of the right renal artery with bilateral arterionephrosclerosis.

JOHN B. McANENY, M.D.

**Cysto-Pyelitis** T. J. D. Lane Irish J. M. Sc. pp 545-555 September 1947

While acute pyelocystitis and recurring subacute pyelocystitis may occasionally present harassing vesical symptoms, it is surprising how often bladder symptoms are absent or minimal in acute pyelitis, chronic pyelonephritis, and chronic pyonephrosis. In the group of cases particularly dealt with here, the state of the bladder dominates both the clinical and pathological picture and the ability to alleviate the vesical condition may determine the fate of the whole upper urinary tract and thus the life of the patient. In order to emphasize the role of the bladder, the term cystopyelitis is suggested. The cases are classified as follows: (1) non specific bacterial subacute (spastic) cystopyelitis—superficial spastic cystitis; (2) non specific bacterial chronic (interstitial) cystopyelitis—contracting interstitial fibrocystitis; (3) amicrobial subacute (superficial) cystopyelitis; and (4) amicrobial chronic (interstitial) cystopyelitis. The words in parentheses refer to the vesical condition.

The following cystopyelographic picture is common to all the varieties of cystopyelitis. In the fully developed case the bladder shadow is small and rounded or angularly rounded. The calices are clubbed and the pelves and ureters on both sides are markedly dilated. There is no evidence of parenchymal erosion, the changes being entirely obstructive. A very striking point is the cone shaped termination of the lower end of

the ureters, the tip of the cone falling short of the bladder shadow by 2 mm to 1 cm or more. In early cases only ureteric dilatation may be noted, and the dilatation of the ureters is relatively greater than that of the pelves and calices. The dilatation of the pelvic segment of the ureters is often much more marked than that of the lumbar segment. In severe cases with incontinence a cone shaped projection of the bladder shadow points downward, denoting an incompetent internal sphincter, or alternatively, the bladder shadow may be extremely small and stellate. In an occasional case the lower end of the ureter, instead of being cone shaped, appears as if it were cut square across. This is probably due to the end of the ureter presenting a different angle to the x-ray beam than in the instances where it is cone shaped. The distance between the termination of the ureteric shadows and the bladder shadow, because of the difficulty of placing the patient absolutely flat and of securing accurate centralization of the x-ray tube, is rarely symmetrical.

In the differential diagnosis of cystopyelitis, encrusting cystitis and chronic interstitial cystitis must be considered. Encrusting cystitis differs from both bacterial subacute and chronic cystopyelitis in that the pyelograms of the upper urinary tract are either quite normal or very near the normal. Except in the most advanced cases of chronic interstitial cystitis, cystopyelography is negative apart from the diminished capacity of the bladder. In tuberculosis of the urinary tract, the pyelocystographic picture is quite unlike that of cystopyelitis.

**Radiologic Signs of Stasis and Increased Ureterorenal Pressure in Intravenous Urography** Robert Coliez J. de radiol. et d'électrol. 28 311-342 1947

The radiologic features of increased pressure within the renal collecting system are discussed. The author, who was the first in France to use ureteral (abdominal) compression in intravenous urography, advocates delayed compression for the following reasons: (1) immediate compression, if complete, risks enclosing a certain amount of non opaque urine in the ureterorenal cavities, thereby interfering with the clearness of the image; (2) Films taken during the pre-compression stage often reveal anomalies of filling and stasis which disappear completely during the course of compression; (3) Some non opaque calculi produce negative shadows during the precompression stage but disappear completely when ureteral compression has been applied, being 'drowned out' by the large quantity of opaque medium.

The minimal signs of ureteropelvic stasis in intravenous urography are best observed before compression is applied. Normally in the pre-compression films there is incomplete filling of the pelvis and calices, but if there is obstruction the renal collecting system is well filled and well defined. The author calls these well defined shadows *images trop belles* ('too pretty' or 'too clear-cut'). If compression is applied early such images may be lost due to overfilling of the uretero-pelvic system.

The etiology, evolution, radiologic forms of hydro-nephrosis and the differentiation from tuberculosis are discussed in detail.

The subject of nephrography is reviewed. Nephrography is said to exist when the kidney is clearly opacified over its entire extent. It is apparently due to stasis of the opaque liquid in the renal parenchyma and is of

three types (1) In *simple nephrography*, the kidney outline, calices, pelvis, and ureter are all visible. The mechanism is not known, but the condition indicates partial arrest of the opaque medium in the renal parenchyma. It is usually found in cases of obstruction in the excretory apparatus. Simple nephrography has occurred in tuberculosis and in obstructive lesions (calculi) situated low in the urinary tract. (2) In *selective nephrography*, the renal parenchyma is strongly opacified but without visualization of the calices, pelvis, or ureter. This has been called an "inverse pyelogram," because the renal hilum is outlined in clear (negative) form. Selective nephrography has usually been found in the acute crisis of renal colic. (3) *Artificial nephrography* has been produced by increasing the intraureteral pressure by means of a mercury bougie, serum injection, or introduction of large ureteral catheters.

The writer also discusses the subject of pyelovenous backflow. In certain cases, urine or a liquid introduced into the renal pelvis during retrograde pyelography flows back out of the renal cavities and penetrates the renal parenchyma. Such extravasations are rare during intravenous urography. Pathologically, acute ureteral obstruction (calculi kinking spasm) is undoubtedly the most common cause. The author designates this phenomenon as *extravasation papillo-calicelle* because it always occurs at the same place, that is, at the level of the fornix calices (papillo-caliceal angle or peripapillary sinus).

Papillo-caliceal extravasations can be divided into two large groups: (1) tubular reflux, (2) extravasations by rupture of the peripapillary sinus with sinus reflux, venous reflux, lymphatic reflux, and even subcortical or perirenal invasion. The characteristic roentgen findings which these extravasations can produce are described.

RODERICK TONDREAU, M D

**Use of Antispasmodic Drugs as Preparation for Intravenous Pyelography** Paul L. Singer. J Urol 58:216 September 1947.

The author suggests the use of an antispasmodic drug prior to intravenous pyelography. He himself has used "depropanex," which was found to reduce the speed of ureteral peristalsis, permitting a greater length of ureter to be filled with dye at any one time and resulting in a more satisfactory pyelogram than would otherwise be obtained. Bowel peristalsis was also reduced, with the result that there was a greatly diminished volume of gas in the bowel.

**Intradermal Test for Sensitivity to Iodopyracet Injection, or "Diodrast."** E. P. Alyea and C. E. Haines. J A M A 135:25-27 Sept 6 1947.

Intradermal skin tests with 0.1 c.c. of diodrast were carried out on a large series of patients who had intravenous pyelography with that compound. The test is read five to ten minutes after the injection. A test in which the wheal formed is 1 cm. or more in diameter and/or the erythema is 1 cm. or more is considered positive.

Reactions to diodrast vary in severity from flushing of the face and neck in a mild reaction to nausea, vomiting, urticaria, rhinitis, lacrimation, edema of eyelids, sense of constriction of the larynx, coughing, rattling respiration, cyanosis, syncope, shock, and even death in a severe reaction.

A small percentage of patients with negative skin

tests had general reactions, but in the group as a whole the incidence was four times as high when the skin was positive. When the patients with a personal history of allergy, asthma, hay fever, or sensitivity to a drug were separated, it was found that the large remainder gave an incidence of positive skin tests and reactions similar to the undivided group. When the patients with personal histories of allergy were then studied, it was found that a high percentage had a negative skin test but a significant number of these had general reactions. However, patients with a history of allergy and a positive skin test had an incidence of reaction to diodrast on the order of 70 per cent.

The authors conclude that tests for sensitivity, either ocular or intradermal, should be made on all patients receiving diodrast. If the test is negative, chance of reaction is less than with a positive test. If there is a personal history of allergy or drug sensitivity combined with a positive skin test, the drug should not be used.

L. A. POZNAK, M D  
(University of Michigan)

**Use of a New Viscous Water-Miscible Contrast Medium Rayopake for Cystourethrography** M. Leopold Brodny and Samuel A. Robins. J Urol 58:182-184, September 1947.

Rayopake appears to be an ideal radiopaque substance for cystourethrography for eight reasons, which are summarized as follows: (1) It affords an excellent gradation of contrast, enabling one to outline the verumontanum, prostatic ducts, strictures and other pathological lesions. Rayopake is water miscible and can therefore be diluted easily should the circumstances warrant. (2) It is miscible with water and urine, thereby avoiding the appearance of droplets at the base of the bladder frequently encountered with oil. (3) Not only is the viscosity high and therefore adequate for urethrography, but in addition it can be easily modified to suit different conditions. (4) No untoward reactions or complications have been noted if and when this medium was experimentally or accidentally introduced into the blood stream in quantities far in excess of those likely to be used in clinical examination. (5) Rayopake is not irritating to the mucous membranes and there is no evidence of any allergic or inflammatory reaction following its use. (6) It does not support bacterial growth. (7) Being soluble in water and urine, it is quickly and normally voided from the bladder after injection. (8) It does not have a destructive effect on rubber and it is easily removed from instruments.

S. A. PATTERSON, M D

**Visco-Rayopake in Cystourethrography** Charles E. Richards. J Urol 58:185-191, September 1947.

Visco rayopake is believed to be the safest and most efficient urethrographic contrast medium yet produced. It has the physical and chemical properties requisite for excellent cystourethrography, which in turn is a valuable diagnostic aid in conditions involving the posterior urethra and the bladder neck. The visco rayopake used in this study contained, per 100 c.c.: 55 gm. 2,4-dioxo-3-iodo-6-methyl-tetrahydropyridine-N-acetic acid, which is the contrast substance; 18.92 gm. diethanolamine, which combines with the acid to form a soluble salt; 3.58 gm. of a polymeric form of polyvinyl alcohol, which is the viscosity base, and distilled water. This gives a concentration of the soluble organic iodide

of nearly 74 per cent on a weight/volume basis. The viscosity of this medium is sufficient to give a good filling of the urethra during urethrography. The iodide content is high enough so that the comparatively thin column of the fluid is sufficiently opaque to afford good contrast. Other advantages include freedom from risk of embolism and non-toxic and non-irritative properties [see preceding abstract].

Cystourethrography requires careful preparation with purgatives and enemas. The patient then empties his bladder, a plain x-ray film is made, a catheter is inserted into the bladder, 2 to 4 per cent sodium iodide is introduced, and the catheter is withdrawn. Twenty-five c.c. of visco-rayopaque is then injected into the urethra and the film is exposed as the last 5 c.c. are introduced. An oblique film is taken at a 45-degree angle while another 5 c.c. is introduced. Finally the patient voids and residual sodium iodide solution is removed *via* a catheter.

STUART PATTERSON, M.D.

### THE ADRENALS

Sympathoblastoma (Neuroblastoma), Adrenal, Abdominal, and Mediastinal. Frederick B. Mandeville. *Urol & Cutan Rev* 51: 448-452, August 1947.

Sympathoblastoma, or neuroblastoma, occurs more often than is generally thought. Up to the time of the present report 427 cases had been reported, though many more had no doubt appeared under other designations. As an abdominal tumor in children, neuroblastoma is believed to be even more frequent than Wilms' tumor.

The author emphasizes certain clinical and roentgen findings associated with these tumors which he believes have not previously been stressed in any single communication. The tumors may arise in any part of the sympathetic nervous system, though they most commonly involve the adrenals. They are more frequently seen in children but occur in adults as well. Not all cases are rapidly fatal, some patients having lived for many years. A suggestive roentgen finding is calcification varying from a fine stippling in the center of the tumor to irregular confluent shadows of increased density throughout the mass. Bilateral symmetrical bone metastases are strong evidence of sympathoblastoma. These are predominantly destructive but include also, radiating spicules especially in the skull, where they are associated with bulging sutures. The similarity of these bone lesions to Ewing's tumor is noted. Ascites is an unusual finding. The tumor is moderately radio-sensitive.

Four additional cases of proved neuroblastoma are reported and three cases originally believed to be neuroblastoma but on review of the sections, diagnosed as Ewing's tumor, ovarian dysgerminoma, and bronchial carcinoma.

MAURICE D. SACHS, M.D.

### APPARATUS, METHODS, TECHNIC

Endoscopic Use of the Biplane Fluoroscope. E. W. Hagens. *Arch Otolaryng* 46: 382-385, September 1947.

Examination with the biplane fluoroscope, as a supplement to the usual technic, has been found useful in bronchoscopy: (a) in localizing a foreign body which cannot otherwise be found; (b) in furnishing accurate and immediate information when the foreign body changes position rapidly or comes apart or breaks; (c)

in determining whether or not the grasp on the foreign body is proper; (d) in finding the new position of an object which has suddenly disappeared from view thus obviating unnecessary roentgen examination and manipulation.

Seven cases in which the biplane fluoroscope was of aid are presented.

Simultaneous Right-Angle Radiographs. Fermo Mascherpa. *Radiol med (Milan)* 33: 441-451, September 1947.

The author describes a device permitting the taking of two simultaneous radiographs at a right angle to each other, which he uses to facilitate arteriography of the brain. The device consists of two tubes focused on two perpendicular cassette holders equipped with separate fixed grids. The milliamperage and kilovoltage of each tube are regulated separately. The resulting radiographs are excellent and the method has the advantage of permitting anteroposterior and lateral study of the vessels at the same stage of filling.

CESARE GIANTURCO, M.D.

Cataloging X-Ray Experiences. Fred Jenner Hodges. *Pub Health Rep* 62: 1129-1140, August 1947.

The system of cataloging x-ray examinations which the author has developed and put to use in the Department of Roentgenology at the University of Michigan is described as having many advantages. Not only are the films accessible, but findings in roentgenograms must be reported in clear definite terms by the radiologist in order that his report can be coded; the accumulated material is easily broken down for statistical study.

There are ten broad diagnostic groups or headings in the system; punch cards are used which carry the identifications of the patients and the diagnostic statements are translated into code. The cards are sorted by fields (groups) and at the end of each calendar year machine sorting is used to arrange the cards in detailed order within the fields.

This system of filing is said to enable one to relive radiological experiences without tedious excursion through voluminous files. The use of microfilms for permanent recording of antiquated, long-untouched films has been employed.

A "Special Interest" category has proved of value in teaching.

ALTON S. HANSEN, M.D.

French Railway (Northern Region) X-Ray Train. Pierre Le G6. *Brit M J* 2: 221-222, Aug 9 1947.

A railway train made up of two sections, (1) a radiological coach, a coach fitted up as living quarters, and a coach fitted up as a waiting room; and (2) a radiological coach which can function independently has recently been completed by the Northern Region of the French Railways and will be used in the prevention of disease among members of the staff and their families. As 600 people a day can be handled, it will be possible to examine every member of the staff of the railroad and their families at least once a year. It is now planned to add another coach for other types of examinations.

The Radiograph from the Physicist's Viewpoint. G. Spiegler. *Brit J Radiol* 20: 319-325, August 1947.

The intensity of the radiographic image is a function of kilovoltage and filtration. The filtration is chiefly

furnished by the object being radiographed. Contrast would be independent of the thickness of the object if it were not for scattered radiation. Decrease in contrast is chiefly due to change in the ratio of scattered to primary radiation.

Intensity and contrast also depend upon the characteristics of the film. The maximum contrast is found along the gamma part of the characteristic curve. Along this section, contrast is proportional to the exposure

The chief cause of blurring (other than motion) comes from scattering of the light from the fluorescent screen in the film and in the screen. This produces blackening outside the boundaries of the primary beam.

In interpreting the films, differences in contrast are usually regarded as differences in absorption. This is erroneous. They may also be due, and usually are, to scattered x rays and, if screens are used, blurring from scattered light.

SYDNEY J. HAWLEY, M D

## RADIOTHERAPY

**Preoperative Irradiation of Carcinoma of the Breast**  
Anatomical-Pathological Considerations. E. Rutishauser and G. Majno. Schweiz med Wchnschr 77 935-949, Sept 6, 1947.

This very interesting report covers 34 cases of mammary cancer given preoperative irradiation and carefully studied, both by histologic investigation of the operative specimens and by clinical methods. The patients were classified into three groups, those unaffected by the radiation, numbering 16, those improved but with the neoplasm not sterilized, 11, and those apparently sterilized, 7. Although sterilization of the cancer was apparently achieved in about 20 per cent of the patients, no relationship existed between this response and the histologic picture. The dose (4,500 to 7,000 r air in about three weeks), or the size of the tumor. In 3 of the 7 "cures" there had been adherence of the skin and in 2 axillary metastases. The authors quote approvingly the recommendations of Neuman (1932) and Sarasin (1947).

**Stenihal I cases** surgery alone and surgery plus preoperative irradiation give identical results, irradiation not essential.

**Stenihal II cases** surgery should preferably be preceded by irradiation.

**Stenihal III cases** preoperative irradiation is a "must."

The following principles are essential in proper irradiation. *First*, sufficient dose, a dose of 3,000-5,000 r appears insufficient, and the authors advocate a dose higher than this. *Second*, treatment of all types, biopsy findings should not be allowed to govern treatment. *Third*, scrupulous observance of the preoperative waiting period, generally four to six weeks are needed, both to allow recovery from the radiodermatitis and to give time for regression of the tumor. *Fourth*, operation should invariably follow even if biopsy shows apparent sterilization of the tumor. This is especially important, as the most radiosensitive tumors are often the most malignant.

LEWIS G. JACOBS, M D

**Treatment of Cancer of the Breast from a Radiologic Point of View**. Raymond Sarasin. Schweiz med Wchnschr 77 953-958, Sept 6, 1947.

This is a general discussion of radiotherapy of breast cancer with a review of some of the pertinent literature, no new material is presented. The author advocates preoperative irradiation and looks favorably on the plan of doing a less mutilating operation than radical mastectomy with the expectation of sterilizing the remaining cancer by irradiation of the node-bearing areas. He advises castration of patients who have not passed the menopause, but since this is often refused, he implants androgenic substances (testosterone or peran-

dren) with the same result. He believes that the use of radioactive isotopes may be expected to lead to further advances in the treatment of this affection.

LEWIS G. JACOBS, M D

**Investigation of Cancer Metastases. Basic Factors for Combined Radio-Surgical Treatment of Breast Cancer**. Hans E. Walther. Schweiz med Wchnschr 77 958-960, Sept 6, 1947.

The author points out that it is common both in breast cancer and in other types for the vessels to be invaded, leading to venous emboli and to distant metastases. In addition local infiltration of the lymphatic channels leads to deposits in adjacent lymph nodes. The first involved are the axillo-pectoral or "axillary" nodes, then the medial or sternal nodes along the internal mammary artery, and finally the caudal deep cervical or "supraclavicular" nodes. The next point of metastasis is the lung, and finally the subcutaneous tissues. This indicates the need of thorough coverage of these regions with x ray, the more so as hidden metastases are normally present at operation in perhaps 45 to 50 per cent of patients.

LEWIS G. JACOBS, M D

**Irradiation of Gastric Cancer**. G. Cranston Fairchild and Alan Shorter. Brit M J 2 243-247, Aug 16, 1947.

Early gastric carcinoma is amenable to surgery, but unfortunately 80 per cent of the cases of this disease are beyond cure when first seen by the surgeon. Palliation, in the form of external irradiation, fails because the depth of the growth prevents adequate tumor dosage. Contact therapy does not insure uniform dosage, and the same holds true for radon seed implants and intracavitary radiation.

Direct irradiation of tumors exposed at operation was first attempted in 1944 by the authors. The advantages of this procedure are (1) More accurate information is obtained as to the size, shape, and position of the lesion. (2) Biopsies may be taken. (3) A greater and more effective dose may be delivered to the tumor directly. (4) Centering of the x ray beam is more accurate. (5) The skin is left intact, which permits additional external irradiation. (6) Various operations to relieve obstruction may be performed prior to therapy.

The authors used two 250-Lv tubes mounted above and below the patient. The half-value layer of the beam equals 1.7 mm Cu. The available surface intensity is 1,000 r per minute from each tube at 21.7 cm focal skin distance. Originally only one tube was used but later simultaneous irradiation was started employing both tubes delivering a minimal tumor dose of 1,300 r. This dose is gradually being raised.

Immediate radiation effects are not superimposed upon the surgical reaction. Radiation reactions occur seven to ten days following treatment and are limited to nausea and anorexia. Blood changes are less severe than those usually seen after external irradiation.

Fifteen cases were treated by the technic described in the past two and three quarter years. In 7 treatment was purely palliative because of the extensive spread of the disease. One patient in this group treated five weeks previously was alive and well, the remainder died within six months of treatment. In 8 patients the growth was limited to the area of irradiation. Of these 1 lived twenty-four months, 2 fifteen months, 1 seven months, 1 four months and 1 three months after treatment. The remaining 2 died within one week.

Methods of surgical approach are discussed and nine case reports included. LOUIS BERNSTEIN, M D

**Radium Therapy of Cancer of the Uterine Cervix and of the Fundus.** Robert E. Fricke. S. Clin. North America 27: 775-789, August 1947.

The author gives a good review of the problem of cervical and uterine carcinoma, setting forth his method of treatment and quoting his five year results. He depends primarily upon radium therapy in carcinoma of the cervix and the amount of x radiation delivered to the pelvis is much less than that used in most clinics. He advocates fractional frequently repeated doses of radium rather than one massive dose in carcinoma of the cervix. He emphasizes the importance of avoidance of trauma in the introduction of radium. He feels that simple applicators, used without trauma, are better than complicated applicators applied without regard to their injury to surrounding structures.

This article presents a fair and rational discussion of the relative value of radiation and surgery in carcinoma of the fundus uteri. The author makes a plea for treatment of patients with extensive apparently hopeless cancer. He feels that palliation in these cases constitutes as much a part of the radiologist's duty as does the attempted cure of early cases.

[This article is well worth the study of any radiologist because of its conservative approach and its broad outlook on the problem of radiation of the cervix and fundus.—R. C. P.]

ROBERT C. PENDERGRASS, M D

**Primary Carcinoma of the Vagina.** Brief Review of the Literature and Reports of Four Cases. Muriel B. McIlrath. M. J. Australia 2: 231-234, Aug. 23, 1947.

This paper includes a comprehensive review of primary carcinoma of the vagina, and includes four of the author's cases, which, she feels, correspond symptomatically and in the results of treatment with those presented in the literature. The author believes that her cases present several interesting features and summarizes these as follows: (1) In 2 cases hysterectomy had been performed ten and eleven years earlier respectively. (2) All patients had had large families and in all there was some degree of prolapse or of gaping of the introitus. One had complete procidentia. Her case was interesting in view of the fact that although she had a large growth and had removed and reinserted a pessary every twenty-four hours, symptoms had been present for only two weeks. (3) Except for one patient, who complained of vaginal hemorrhage and discharge

for four years, the history was of short duration. (4) Radiation treatment was the only method used, probably because the patients were elderly and in poor physical condition and radical surgery was impossible. (5) In one case evidence of recurrence was shown three and a half years after treatment. (6) All the other patients are dead, recurrence taking place in six months, seven months, and four months, respectively.

All authors agree that primary vaginal carcinoma is difficult to treat. Various reasons have been advanced. The condition is so rare that it is doubtful whether any one center has had sufficient experience to develop a suitable technic. The disease is usually well advanced when the patient is first examined, the undifferentiated type of cell of which the tumor is composed would be responsible for a rapid growth. The vagina is a thin walled structure richly supplied with lymph vessels and surrounded by loose connective tissue. There is, therefore, no effective barrier to local spread, and metastasis to lymph nodes occurs early. The spread is to the inguinal nodes if the growth is in the lower third of the vagina, to the external iliac and hypogastric nodes if the growth is in the middle third, and into the sacral nodes if the superior two thirds of the vagina are involved. Finally the bladder and rectum which are easily damaged by radiation come into intimate relationship with the vagina.

No illustrations accompany the article. There is a good complete bibliography.

ERNEST S. KERÉKES, M D

**Hemolytic Anemia Associated with Malignant Diseases.** Daniel Stats, Nathan Rosenthal and Louis R. Wasserman. Am. J. Clin. Path. 17: 585-613, August 1947.

Hodgkin's disease, chronic lymphatic leukemia, reticulo-endotheliosis, metastatic carcinomatosis, sarcoma of the spleen, myelogenous leukemia, lymphosarcoma, giant follicular lymphoblastoma, and Boeck's sarcoid are occasionally complicated by symptomatic hemolytic anemia. The blood picture and bone marrow in such cases may reflect changes caused by both diseases. Spherocytosis and increased fragility of erythrocytes in hypotonic salt solution occur in about 50 per cent of the cases. The pathologic changes in the spleen are variable. In some cases "arterial" or active hyperemia is present, in others the specific changes of the underlying disease are observed. In certain instances "non-specific" alterations such as reticulo-endothelial hyperplasia, erythrophagocytosis, and myeloid metaplasia are seen. The reason for this variation is not clear, it is not dependent upon any of the hematologic findings.

The unpredictable effects of, and indications for various forms of therapy are discussed. (1) If the hemolytic component is severe and overshadows the underlying disease, and the condition of the patient does not warrant delay, splenectomy without preoperative radiation should be performed. Radiation to other involved areas may be given at a later date. When the anemia is of hyperactive onset, splenectomy may be impossible, and frequent blood transfusions should be administered. (2) In patients with lymphoblastoma who are in good general condition, the authors recommend radiotherapy to the spleen and to any other areas involved in the disease process. If the hemolytic process continues unabated or becomes more severe, splenectomy, followed by postoperative radiation if necessary, should

be carried out. These considerations may be modified by the use of radioactive elements for internal radiation. (3) Patients whose hemolytic anemia continues unchanged after splenectomy should be subjected to thorough study in order to ascertain the presence of neoplastic disease. If found, this should be treated by radiation or extirpation, where feasible. (4) There are no precedents for the successful treatment of symptomatic hemolytic anemia complicated by metastatic carcinomatosis. It would appear that the principles already mentioned should be applied to such cases. (5) Transfusions of properly grouped and matched blood may be given repeatedly to patients with symptomatic hemolytic anemia as supportive or preoperative medication.

The occurrence of spontaneous remission is pointed out. Summaries of 10 cases illustrating the clinical and hematologic findings and the response to treatment are given.

#### Common Vascular Nevi and Their Treatment.

Anthony J Delario. *Urol & Cutan Rev* 51:465-476, August 1947.

Vascular Nevi and Their Treatment. A. J. Delario. *J. M. Soc. New Jersey* 44:360-370, September 1947.

The major types of vascular nevi are described in the two papers listed above. Treatment depends upon the type of nevus present, its size, location, and duration. Hygromas should be removed surgically. Surgery, electrocoagulation, solid carbon dioxide, radium, and x-ray therapy have been used in lymphangioma simplex, and cavernous lymphangioma, and hemolymphangiomas with good results when the proper form of treatment was selected for the individual case. The mixed hemangiomas and lymphangiomas respond as well to irradiation as either type of lesion alone. In general, the author prefers radium or radon because of the ease of application.

The paper in the *Urologic and Cutaneous Review* is accompanied by a large number of illustrations, including photomicrographs and photographs showing the effects of treatment.

Roentgen Therapy of Pain. René Gilbert. *J. de radiol. et d'électrol.* 28:343-353, 1947.

The first part of this article deals with the clinical application of roentgen rays in various painful diseases. In the second portion, the mode of action of x-rays on pain is discussed.

The treatment of two large groups of cases is reviewed: (1) pain of known cause including the acute and chronic inflammatory diseases, neoplasms, vasomotor disorders of the heart and extremities, (2) pain of unknown cause, especially the "essential neuralgias."

Particular attention is paid to the treatment of sciatic neuralgia which the author states of all the neuralgias offers the best chance of success. Two paravertebral fields are treated approximately  $8 \times 17$  cm each, from the level of D 10 to L-3. The tube is directed toward the midline at an angle of 20 to 25 degrees. The technical factors are as follows: 160 kv, with filtration of 0.5 mm Cu + 1.0 mm Al, skin target distance 40 cm. The patient is treated three times weekly to a total of six to eight sessions. The dose is 125 r per field measured at the skin. Treatment thus requires about fifteen days and the total dosage to the treated area is 1,500 to 2,000 r. If, after the second or

third treatment, no improvement is noted, irradiation is directed over the course of the sciatic nerve in doses of 100 to 125 r per field. In cases which do not respond, the region between L 4 and S-3 may be treated. In a group of 72 cases, 47 (65 per cent) were cured, 18 (25 per cent) improved, 7 (10 per cent) unimproved.

RODERICK L. TONDREAU, M.D.

Abuses of X-Ray and Radium in Dermatologic Conditions. A. H. Lancaster. *South M. J.* 40:666-669, August 1947.

One of the greatest abuses of radiation therapy lies in its employment as a matter of routine without a working diagnosis. The abuses very often are in dermatologic conditions in which x-ray is most useful. At times too little, but more often too much irradiation is given. Especially is the latter true in inflammatory, metabolic, and contact dermatoses. In acne x-ray is grossly abused, yet in many cases it is indispensable. The radiologist should have the courage to discontinue its use when expected results are not obtained. The same can be said for many other dermatologic conditions, as psoriasis, lichen planus, mycotic infections, and particularly the contact eruptions.

The therapy machine must be thoroughly calibrated and frequently checked. When using filtered x-radiation one should keep in mind the depth dosage and the indications and contraindications for such a dose in any particular area, since x-ray therapy in dermatology is frequently over organs which are highly radiosensitive. With more than one exposure consideration should be given to the factor of overlapping of the rays. All tissues not needing treatment should be protected, and each area should be carefully examined before the next treatment.

Much has been written on idiosyncrasy to x-rays. Most authorities today do not believe in a true idiosyncrasy but rather in a variation of tolerance. The author therefore recommends testing the tolerance of patients if many treatments are to be given.

We see numerous circumscribed areas of the skin showing chronic x-ray changes from treatment given in the past to benign or precancerous lesions. Such areas are often more disfiguring and more dangerous than the original pathologic condition. In the young, x-ray and radium have a definite place in the treatment of certain types of angioma, but the author believes we should proceed with caution in the treatment of verruca vulgaris and relatively benign lesions. In the benign epithelial lesions, electrosurgery gives us favorable cosmetic results and a healthy scar. In lesions of low grade malignancy we can obtain as many cures and better cosmetic results by electrodesiccation or by a judicious combination of electrodesiccation and radiation.

The use of radium should be limited to small lesions such as hemangiomas, malignant growths, and small keloids. Too often this agent is abused and so is the patient, by the attempt to treat lesions of various sizes and shapes with a single type of applicator.

The author also emphasizes the importance of securing accurate information as to the amount of x-rays administered in the past before a patient is given further treatment.

Public opinion enters into the use of x-ray and radium in many instances. There are those who believe that x-ray is the cure for all ailments because they know of someone who attributes his cure to x-ray. This type of

person almost demands that x-ray be used to the exclusion of other procedures. On the other hand, there are patients who know of others who have been burned with x-rays and, because of this, refuse x-ray therapy when it is absolutely indicated.

BERT H. MALONE, M.D.

**Discussion of Radiotherapy in the Treatment of Non-malignant Superficial Eye Lesions.** R. Affleck-Greaves, B. W. Windeyer, M. Lederman *et al.* *Proc. Roy. Soc. Med.* 40: 570-577, August 1947.

Greaves, having obtained favorable results with irradiation in spring catarrh or conjunctivitis, tried the method also in superficial lesions of the cornea. He obtained good results in acne rosacea keratitis, recurrent abrasions, superficial punctate keratitis, and phlyctenular keratitis but had no success in Mooren's ulcer, dendritic ulcer, or deep keratitis.

Windeyer discussed the unfavorable effects of irradiation on the eye and outlined the technique used in the Middlesex Hospital for treatment of superficial non-malignant conditions. This is designed to overcome such dangers both by the direction of the beam to avoid the lens and by limitation of the dose to an amount which has been shown to be well tolerated and insufficient to cause any damage. Technical factors are as follows: 95 kv, 1 mm aluminum filter, 2.5 milliamperes current, 18 cm focal skin distance. The cornea is irradiated from the lateral and the medial sides using a beam which is sharply defined by means of a lead glass applicator with a 2.5-cm diameter aperture. The tube is arranged for each field so that the lower margin of the beam only is directed across the cornea and irradiation of the lens is avoided, but the whole of the surface of the cornea is irradiated. The patient is treated with the eye open. A dose of 100 r measured at the aperture of the applicator is delivered to each field. Taking into consideration the distance from the end of applicator to the center of the cornea which is calculated as 1.8 cm, and the fact that the extreme edge of the beam is used, it is estimated that the cornea receives a dose of 60 to 65 r from each field or a total of 120 to 130 r per treatment. The dosage is repeated if necessary at fortnightly intervals, up to a maximum of four treatments in a single course. Best results have been obtained in acne rosacea keratitis, recurrent abrasions and erosions and superficial punctate keratitis. The method has been less effective in Mooren's ulcer and spring catarrh.

While recognizing the advantages of roentgen therapy, Lederman believes that beta radiation offers advantages in the treatment of certain lesions of the cornea, limbus and conjunctiva. Similarly gamma radiation possesses some advantages over x-radiation in the treatment of hemangiomas and keloids. The purpose and technique of treatment vary from group to group but the underlying principle is to give the smallest possible dose which will achieve the desired results. In the roentgen therapy of superficial punctate keratitis and acne rosacea keratitis, Lederman begins with a minute dose of 10 to 15 r, gradually increasing to a final dose of 40 to 50 r, treatment being given twice a week for a total dose of 200 to 250 r. Good results were also obtained in corneal ulceration and recurrent erosion with a single dose of 75 r.

A. J. Durden-Smith reported a series of 40 cases of Mooren's ulcer treated by contact radiation with radium, the applications being given as a rule three times at intervals of six weeks, whether or not the pri-

mary result is satisfactory. The radium applicators are of full strength 5 mg per sq cm, and are substantially unscreened, the contact surface consisting of 0.1 mm monel metal. The most usual sizes are 1.0 and 1.25 cm in diameter. An applicator gives 6,000 r per hour on the surface and the intensity is uniform over the whole area of the applicator. The intensity falls off very rapidly in the surface layers of the cornea being about 50 per cent at 1 mm and 25 per cent at 2 mm. Treatment time is short and there is no caustic action. Of the 40 cases treated by this method, approximately 50 per cent did well for a period long enough to hope that they would remain healed permanently and over 25 per cent of the rest did well primarily.

SAVA M. ROBERTS, M.D.

**X-Ray Therapy as an Adjunct in the Treatment of Bronchial Asthma. A Preliminary Report.** Katharine Baylis MacInnis. *South Med. & Surg.* 109: 305-306, September 1947.

The author has found x-ray therapy of benefit in certain cases of bronchial asthma. While it is not to be used indiscriminately, or to the exclusion of orthodox methods of treatment, she believes it may be of great advantage for temporary relief where the usual methods of treatment have not given all of the benefits desired. She presents 4 cases of moderately severe and continuous asthma in children treated by irradiation. Results evaluated after six months were favorable in 3. The patients selected for treatment had responded poorly to diet, rest, desensitization, vaccine therapy, etc. The disease was believed to represent a combination of the atopic and the sino types of bronchial asthma, predicated on an allergic basis.

In the technique employed, the factors for treatment over the sinuses and mediastinum are 200 kv, 0.5 mm copper plus 1.0 mm aluminum filter, skin-target distance 50 cm. The sinuses are treated through three ports, one anterior and two lateral. Anterior and posterior mediastinal ports, 10 x 15 cm, are used. When intra-oral therapy is given, the cone is placed in the mouth, and treatment is given at 120 kv with 3 mm aluminum filter. The interval between treatments is usually five days, and for the first three treatments only one area is treated. When no untoward reactions are noted, two areas are then treated, *i.e.*, over the sinuses (which would include the pharynx) and over the mediastinum. Each area receives four treatments, averaging 50 r per treatment. Two hundred r are given as an intra-oral dose when intermediate therapy is used. Never more than two such doses are given in any one case. The author states that x-ray films of the chest substantiate the clinical improvement, but no illustrations are shown.

ERNEST S. KERESKES, M.D.

**Relation of Deep Roentgen Therapy to Aero-Otitis Media.** Francis O'N. Morris. *California Med.* 67: 100-102, August 1947.

The author reports a series of 37 cases, observed while on duty with the Air Corps, in which roentgen therapy was given for persistent aero-otitis or deafness at high altitude. Preliminary studies in these cases were made to establish the fact of difficulty in aerating the middle ear and to eliminate allergic conditions, chronic disease of the ear, chronic infection in the nose, paranasal sinuses or pharynx which would stimulate and perpetuate lymphatic tissue hypertrophy about the eustachian tube, and psychoneurosis. In 25 of the

cases nasopharyngeal examination showed excessive lymphoid tissue about or near the eustachian orifices

The radiation was given through a lateral port on each side with 10 cm circle centered over the eustachian tube, the following factors being utilized 200 kv, 10 ma, 50 cm distance, 0.5 mm of copper with 1 mm of aluminum added filtration. Treatment was given at seven-day intervals with an average dose of 100 r to each side per treatment. The number of treatments was either four or six, depending on the apparent severity of the eustachian obstruction. The total average dose was 400 or 600 r to each side. Since this amount of radiation is considered minimal, it was possible to give a second series of treatments after six or eight weeks without possible damage to the tissue irradiated.

Four to six weeks following roentgen therapy the patients in this series were re-examined. Those who had complained of deafness associated with faulty eustachian patency were found to have normal hearing. All except one passed as normal the follow-up pressure chamber and aerial flight tests. They were then returned to full military flying duty and had no further known ear difficulty.

The importance of careful selection of cases for irradiation is emphasized.

MAURICE D. SACHS, M.D.

**Roentgen Therapy in Chronic Mastitis** George E. Pfahler and George P. Keefer. *Pennsylvania M. J.* 50: 1347-1354, September 1947.

Chronic mastitis is a term applied to a condition of the breast characterized by pain and tenderness, usually preceding the menstrual period, and by diffuse and localized nodularity of the breasts which is often bilateral and most often affects the upper and outer quadrants. According to Ewing, the many forms of mastitis are due to an exaggeration of single features of chronic inflammation which passes insensibly into chronic hyperplasia and then into neoplastic hyperplasia. Ewing, Warren and others have shown that chronic cystic mastitis and chronic mastitis predispose to breast cancer.

The authors argue that because almost every form of infection responds favorably to radiation therapy, it is only logical to expect a favorable response to the radiation treatment of chronic mastitis and that by eliminating this chronic mastitis we may prevent the development of cancer in some cases.

For convenience of discussion cases of mastitis are divided into three groups:

(1) The psychic group, where nothing abnormal can be felt and where symptoms are not related to the menstrual period. In these cases small doses over the pituitary and the breasts may be of value.

(2) The neuralgic group, where pain may be traced along the intercostal nerves, the brachial plexus, and to the spine. The pain is not influenced by the menstrual period. Small doses of roentgen therapy and diathermy often produce good results.

(3) Chronic productive mastitis with which the authors are chiefly concerned, in which the breasts are firm or nodular, becoming more painful at the menstrual period. Where there is a solitary mass with firmness and small nodules on the opposite side, one is justified in treating for not more than a month. A discharge from the nipple, if serous, is not likely to indi-

cate cancer, if bloody, it is cancerous in over 50 per cent of cases.

Radiation therapy is confined to the part of the breast involved, usually a 6 X 8 cm cone is large enough. Four to six treatments are given, the first two being a week apart. A third is given two weeks later, and the fourth and fifth after intervals of four weeks. The factors are 180 to 200 kv, 0.5 mm Cu filter, 375 r per sitting. To obtain safe and satisfactory results, only a trained radiologist should attempt this work.

In the authors' series, 151 cases were treated. In 111, or 73.6 per cent, complete recovery followed, an additional 36 cases, or 23.8 per cent, showed marked improvement.

JOSEPH T. DANZER, M.D.

**X-Ray Therapy in the Treatment of Para-Arthritis of the Shoulder. A Study Based on the Treatment of 64 Cases** M. Lowry Allen. *Rocky Mountain M. J.* 44: 621-626, August 1947.

A series of 64 cases of para-arthritis of the shoulder treated by roentgen irradiation is reported. Both acute and chronic types are included, and the patients ranged in age from twenty-four to eighty years. Men outnumbered women in the series. Questionnaires were sent to all patients, and the follow-up was pursued with thoroughness.

Something over 60 per cent of the group testified to very great relief of symptoms, and the answers are tabulated as to pain, limitation of motion, etc.

The author reviews the subject carefully in the beginning and mentions all the synonyms, bursitis and peritendinitis being the ones most frequently employed. He is in accord with other writers in finding the most refractory cases among the most chronic. The more acute the condition, the better, in general, is the response to radiation.

PERCY J. DELANO, M.D.

**Radioactive Phosphorus, P<sup>32</sup>. A Six-Year Clinical Evaluation of Internal Radiation Therapy** Charles A. Doan, B. K. Wiseman, Claude-Starr Wright, Joseph H. Geyer, William Myers, and Jo W. Myers. *J. Lab. & Clin. Med.* 32: 943-969, August 1947.

This is a review from the Research Department of Medicine of Ohio State University, covering its activities with radioactive phosphorus since 1941. The report is quite similar in scope and nature to that of E. H. Reinhard *et al.* (*J. Lab. & Clin. Med.* 31: 107, 1946; *Abst. in Radiology* 48: 105, 1947).

This review covers 100 cases: 20 cases of polycythemia rubra vera, 18 of acute lymphatic leukemia (leukosarcoma), 11 of chronic lymphatic leukemia, 1 of acute and 13 of chronic myelogenous leukemia, 9 of acute and 1 of chronic monocytic leukemia, 16 of Hodgkin's syndrome, 5 of metastatic carcinoma and sarcoma, 4 of multiple myeloma, 1 of mycosis fungoides, and 1 of exfoliative dermatitis.

The evaluation is similar to that generally reached. The response in polycythemia was good. Acute cases of leukemia responded poorly, in some of the more chronic cases, a good response was produced, but where there were localized swellings due to leukemic infiltrations local external radiation therapy was employed. Little effect was observed in patients with monocytic leukemia. In Hodgkin's disease no benefit was derived. Full details are given for all of these cases, with serial blood counts, and graphs showing the effect of treatment on the blood picture in individual cases are included.

SYDNEY F. THOMAS, M.D.

**Histological Localization of Radioactive Elements (A Review)** J Gross and C P Leblond *Canad M A J* 57 102-122 August 1947

This review covers in some detail the radioautographic study of human and animal tissues. This technique the authors believe may be of advantage in many forms of biological and clinical investigation. Besides giving a clearer understanding of fundamental biological phenomena it is hoped that the technique will be of help in discovering specific localizations for various substances and thus finding new possibilities for localized destruction. Clinical applications of radioelements

are fraught with many dangers and uncertainties, however, and should be restricted to elements thoroughly investigated by animal experimentation. Very few isotopes have been studied so far: polonium, four elements involved in bone metabolism, phosphorus, calcium, strontium, and lead, and iodine specifically connected with the thyroid gland.

A bibliography of 52 references is appended, beginning with Becquerel who observed the ability of radioactive rays to affect photographic emulsions more than half a century ago, even before radioactivity itself had been recognized.

## RADIATION EFFECTS

**The Tolerance Dose and Prevention of Injuries Caused by Ionizing Radiations (Silvanus Thompson Memorial Lecture)** Rolf M Sievert *Brit J Radiol* 20 306-318 August 1947

With the development of atomic energy protection against injury by ionizing radiations will assume personal and social proportions not hitherto encountered. Particular concern must be given to effects on the skin, blood and blood-forming organs and sex glands.

The range within which a skin reaction changes from a mild erythema to an irreversible reaction is relatively small. Fractionation is accompanied by reduced skin reaction. Strandqvist found that 1 000 r in a single dose produced an erythema and 3 000 r skin necrosis. With fractionation over thirty days erythema appeared after 2 600 r and necrosis after 8 000.

Blood changes are difficult to evaluate because of normal variations. The most pronounced changes seen are hypersegmentation, pathological lymphocytes, granulocytopenia and a shift to the left. Thrombocytes diminish after irradiation.

Sterilization is generally considered to follow 300 to 400 r in a single dose. This figure is so low that with radiations of short wave length, sterilization may occur without any erythema. Blood changes generally appear before sterility need be feared.

The tolerance dose may be expressed in two ways, the 'active tolerance dose' which is the lowest dose capable of producing observable ill effects, or the 'safety tolerance dose' which is the maximum allowable for persons working with ionizing radiations. Either expression should take into consideration the conditions, the source of the radiation (whether hard x- or gamma rays, neutrons etc.) and whether the radiations are generated within the body or outside. In general the safety tolerance dose should be about 0.1 to 0.2 the active tolerance dose.

From Strandqvist's curves the skin tolerance dose is between 0.1 and 0.5 r per day. This is in close agreement with the opinion of other radiologists.

Studies of different types of risks indicate that the safety tolerance dose for blood changes is about 0.01 r per day. As little as 0.02 to 0.05 r can produce blood changes. For radiations originating within the body the equivalent of  $10^{-11}$  to  $10^{-10}$  curies per liter should not be exceeded.

There are not sufficient data to establish a tolerance dose for genetic effects or for effects upon sterility.

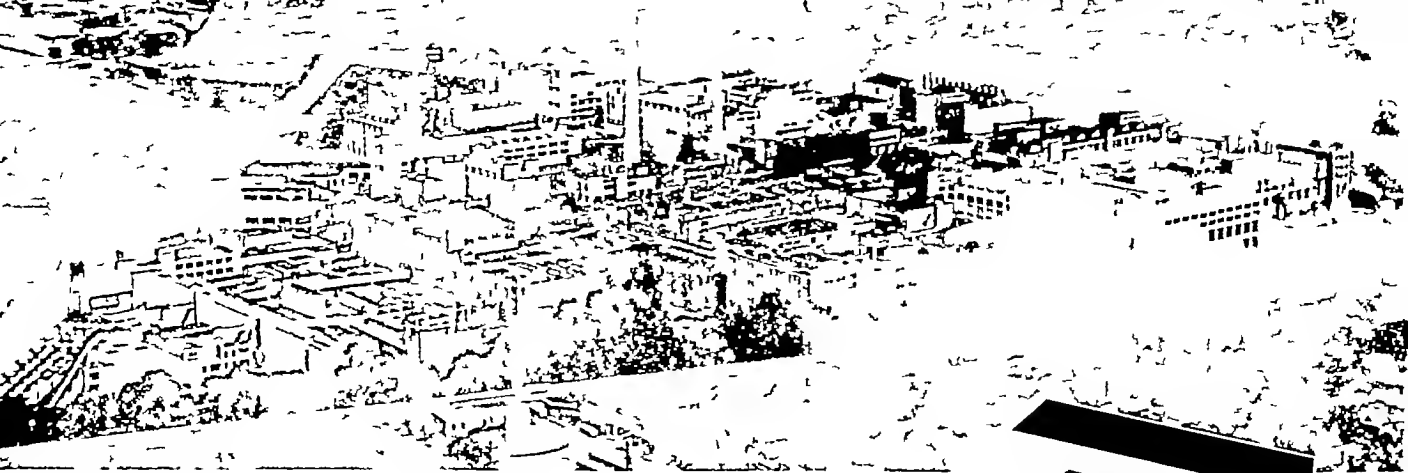
The Institute of Radio-Physics in Stockholm after many investigations in x-ray and radium departments, has found that measurements by condenser chambers and Geiger-Müller counters are disappointing, particularly in diagnostic departments. They conclude that negative results of such measurements are of little value, only the positive ones are significant. Measurements are not an adequate substitute for regular physical examinations and blood counts.

A summary of the Swedish law regarding control of radiological work is given. The owner of an x-ray apparatus and radioactive preparations is required to have a license from the state. Periodic inspections are required. Workers are obliged to have regular examinations and authorization to work from a medical board. Standards of protection are set up and enforced by the Institute of Physics.

The law has been in force since 1941. Conditions in radiological departments supervised by radiologists have been found satisfactory. Considerable risk has been discovered in small installations not controlled by trained radiologists. Dental radiography always regarded as relatively safe, was found to offer considerable risk. Studies of mass miniature radiography technique have shown great opportunity for injury to the blood.

SYDNEY J HAWLEY M D

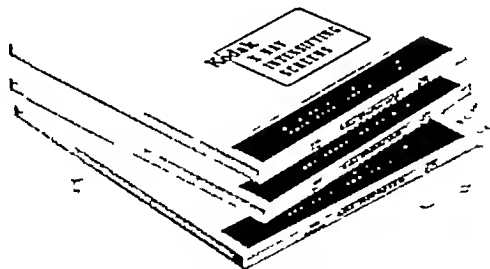




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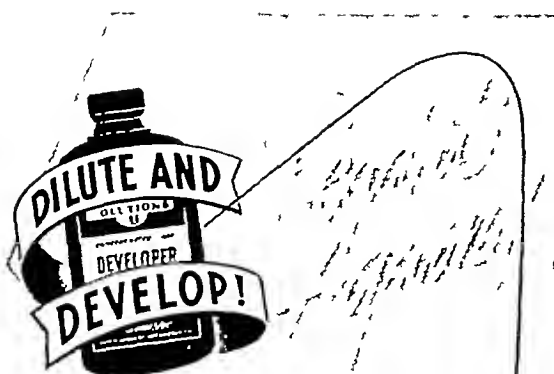
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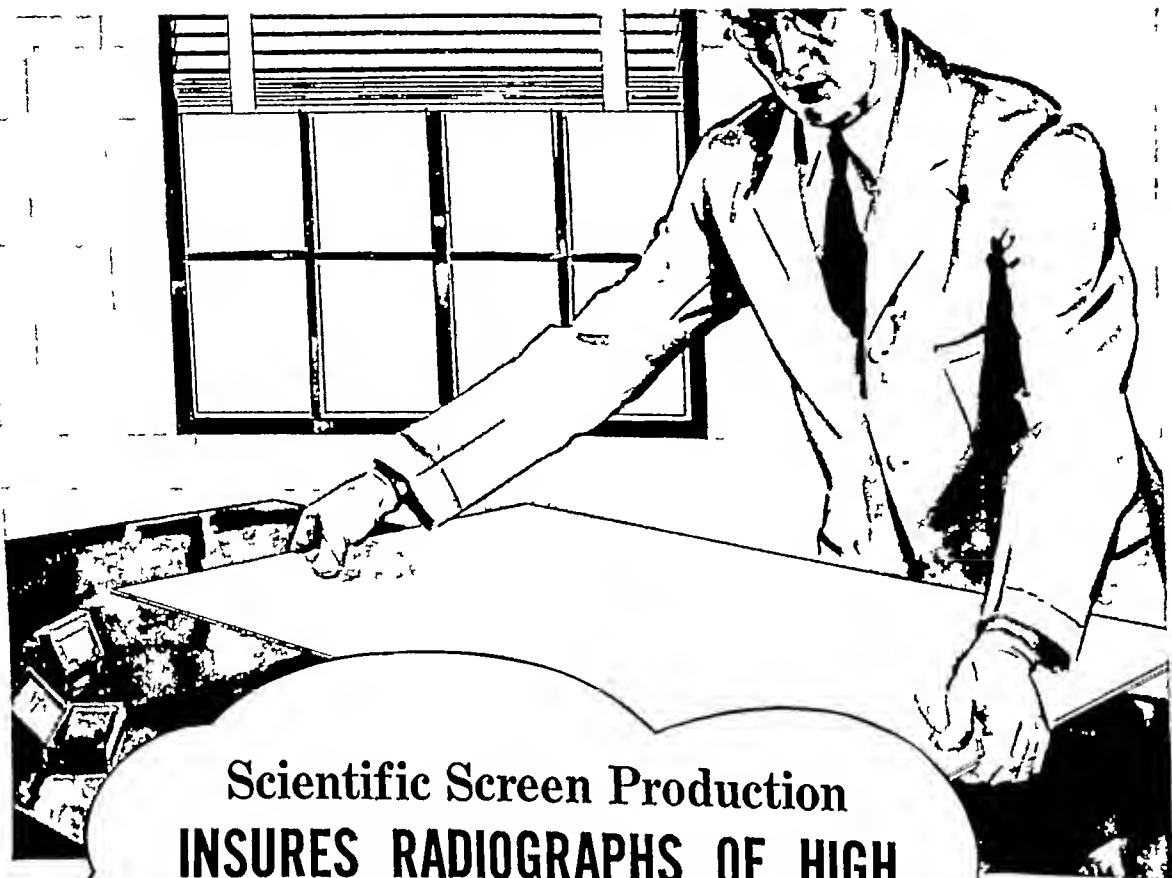
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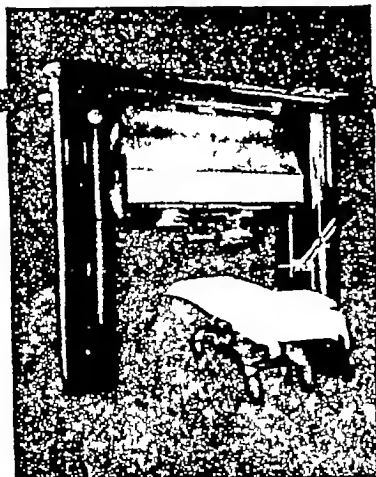
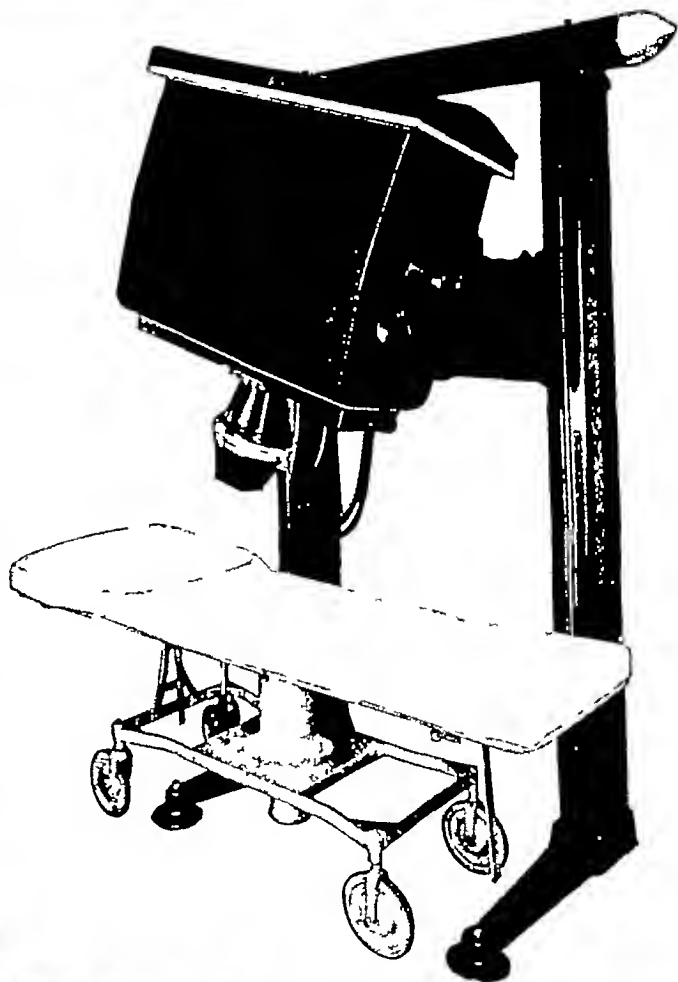
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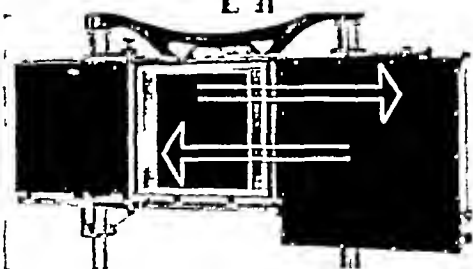
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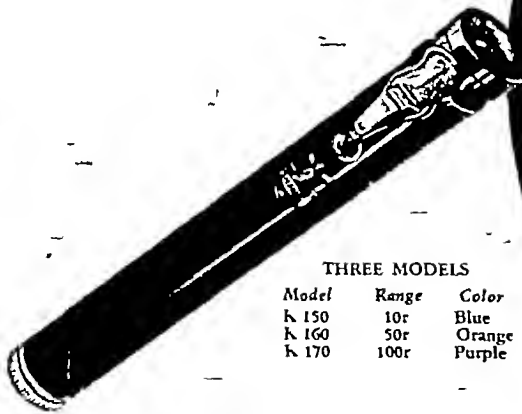
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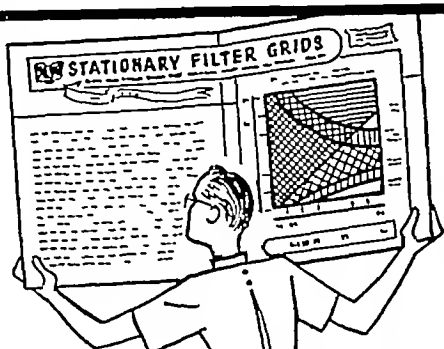
### THREE MODELS

Model	Range	Color
K 150	10r	Blue
K 160	50r	Orange
K 170	100r	Purple

WRITE for "Keleket" Bulletin Q 1 which describes the High Range Dosimeters in detail



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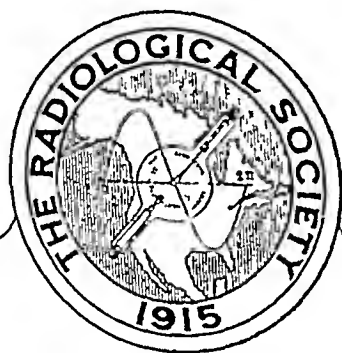
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SAN FRANCISCO, DECEMBER 3

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